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## DISTRIBUTING ELECTRICITY.

IN British electrical circles the case of the alternating system versus the battery system of distribution has been argued and discussed very fully, although no definite conclusions have been reached; nor is it to be expected that any valuable conclusions can be drawn from hypothetical cases such as those put before us in the discussions, as figures may be made to prove anything in the absence of facts. All are agreed, however, that both systems require for their economical operation as distribution systems on a practical scale a high pressure current of electricity in the main wires or distributing conductors. For the further progress of the electric light and power industries such high pressures are absolutely necessary, that is to say, a pressure of about 2,000 volts, low pressure systems working at about 200 volts at most.

The parallel system of distribution by alternating currents at high pressure and transformers requires for its operation a network of main conductors maintained at constant high pressure. In some cases 1,000 volts and in others 2,000 volts are employed, and such pressures are altogether new to most electricians. High pressures like these have never before been used for parallel distribution, although we are quite familiar with high pressures for distribution in series order in the Brush and Thomson-Houston arc systems and in the early proposals in connection with transformer systems in series, but in these systems the high pressure exists at the dynamo terminals only. The pressure between the terminals of each lamp is only 50 volts or thereabouts, and so in the series system of operating transformers the pressure is high only at the dynamo terminals, and the pressure may be much lower between the primary terminals of a series transformer than between its secondary terminals, a fact which is often not considered, but in the parallel systems the high pressure is all over the whole system of main conductors, and is as nearly equal all over as possible.

These high pressure systems have met with opposition on various grounds both here and abroad, and in America, where the alternating systems have been making extraordinary progress under the energetic control of the Westinghouse Company, the alternating current has been singled out for special opposition, chiefly on the ground that it is very dangerous to life. Why the alternating current is supposed to be more dangerous than the continuous current, the pressures being equal, has never been satisfactorily explained, but it seems to arise from the afore-mentioned facts, viz., that high pressure continuous currents have been long in use in series systems where the extreme pressure is only at the dynamo. Successful alternate current distribution demands a constant high pressure all over the main conductors, and on that account may be somewhat more dangerous than the high pressure series systems using either continuous or alternating currents.

The outcry in America is against the alternating current alone, and is somewhat unfair; the opposition to be rational should be raised against high pressure currents, alternating, pulsating or continuous. In fact, from the statements made by those who have experienced the shocks delivered by both continuous and alternating currents, we might gather that the alternating current is the safer of the two, and the writer of these remarks had the full shock from two terminals at 1,000 volts pressure from an alternating dynamo without suffering any serious injury.

The alternating current dynamo has one advantage over the continuous current dynamo, as far as safety goes, in not producing any extra current on breaking the circuit.

But, granted that all high pressures are dangerous, it is surely quite within the resources of the electrical engineer to apply methods of insulation and construction to meet any objections. One thing is certain, we must use high pressures for distributing purposes, either alternating or continuous, and although we may not affirm that the alternating current is safer, it may be accepted that the continuous current is equally as dangerous.

On this side we have no very extensive experience of any distributing systems, but in America there has certainly been a fair trial of the alternating high pressure system and of the low pressure continuous system of distributing, and in no case has there been found in the high pressure systems any difficulties in rendering the main wires quite safe. In any case the question is not one between alternating currents and continuous currents but a question as to whether we are to use high pressures or low pressures.

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WE all know that, like seven, three was considered a mystical number among the nations of antiquity and we have often seen pictures portraying the three graces, and the artist's idea of Adam, Eve, and the serpent. Who, too, has not heard of the three tailors of Tooley Street? In modern times it would seem that this mystic three still hold sway, Miss Braddon's latest novel being called "The Fatal Three," and in a late issue of the *Daily News*, under the heading of "Electric Light in London," we notice that three gentlemen are posing as the pioneers of submarine telegraphy, rather, we think, to the amusement of those well acquainted with the history of that important branch of our national industry. Now it is known that the same trio, supported by relatives and others, who, we think, should not hold that position, are asking the public in a "stand and deliver" fashion to supply them with a large sum of money so that they may try the practicability of house to house lighting by electricity. The whole thing assumes a very serious aspect, and we have no hesitation in saying that they are presuming far too much upon the credulity of the public, who, as a whole, are ignorant of the history both of submarine telegraphy and of electric lighting.

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MR. ARTHUR CHAMBERLAIN and the Leamington Town Council do not get on well together. Recently Mr. Chamberlain offered to erect at his own cost four arc lamps of 2,000 C.P. each upon the Town Hall tower, 100 feet high, with the object of showing the effect of lighting open spaces by means of arcs in conjunction with incandescent street lighting. The council did not care to have the arcs on the Town Hall tower, but asked Mr. Chamberlain to put them up on the Parade. This has called forth a letter from Mr. Chamberlain, which the Leamington councillors, or some of them, stigmatise as rude, the work of an irritable and foolish man, and other pleasant things. He withdraws the offer, and also a former one to bear half the cost of improving the appearance of the street incandescent lamps and exchanging 32 C.P. lamps for those of 16 C.P. which at present light the streets. His reasons he states in these terms:—"We find that our motives are not appreciated. We are supposed to be madly desirous for a continuance at any cost of our present contract for lighting the Parade, whereas, as a matter of business, we don't care about lighting the Parade at all. As far as the Parade is concerned, our chief desire was to assist the more public-spirited members of the council in bringing Leamington abreast of the times. The system of lighting recommended by us we admit—but discussed in full conclave and adopted unanimously—does not appear when in practice to please the council. This is a matter of taste and not of electrical engineering, but still we were willing to assist the council in any change they desired, but every offer we make is used by our opponents as the excuse for some attack on our reputation and some fresh outpourings of local spite and local prejudice. When we have been personally present we have had no reason to complain of the result of the discussion, but behind our backs the matter is different. Then statements are made to our disadvantage that are unsupported by any evidence that would be received in a Court of Justice, and that are untrue in fact, and no effort is made to distinguish between legitimate criticism of matters of taste and opinion, such as the method of distributing the light and the appliances by which it is distributed, and for which matters the council are now alone responsible, and that other matter, for which only we are responsible—the candle-power of the lamps." Mr. Crowther Davis, notwithstanding that he thought this letter an unfortunate one for the writer and not for the recipients, withdrew a motion, of which he had given notice, to terminate Messrs. Chamberlain and Hookham's contract for lighting the Parade lamps upon 12 months' notice, avowing as his reason a desire to "leave no means whatever untried whereby an accommodation might be found as between the council and the electric light company, and that the latter should feel that no hasty step had been taken to put an end to the contract." The question involved was eventually referred to a committee of the whole council.

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ON Saturday last there was enacted a little scene which appears to have escaped the observations of those gentlemen who fill the daily papers with such graphic descriptions of the naval manœuvres. This was no less an exploit than the capture of Immisch's floating charging station near Kew, by the mixed crew of the electric launch *Volta* who volunteered to a *man* for the exciting duty. The time of making the attack was well planned and took place in broad daylight during the progress of a regatta, and before Mr. Immisch could fire the bearings of his engine and dynamo or discharge his accumulators, he and his charging station were in the hands of his friends, the enemy. After subjecting the interior to a searching scrutiny without discovering even an empty bottle, and Mr. Immisch to an examination which afforded the captain and officers of the *Volta* but little satisfaction, and having chalked upon the station the legend "Captured by the *Volta*," the smart little craft proceeded on her way down the river successfully running the blockade, as on the up trip, of both Thames Conservancy and Police, whose boats were of no avail in a trial of speed. The success of the manœuvre was entirely due to the happy thought of pressing a number of ladies into the service, and under cover of these the crew of the launch, which, to all appearance, was an innocent-looking pleasure boat, bore rapidly down upon the station with the result which we have made known. The only casualty during the day was that of a glove falling overboard; this, however, was speedily recovered little the worse for the immersion. This is the second prize which has fallen to the lot of the *Volta*, as in addition to dropping down upon Mr. Immisch unawares, she is the only boat which ever caught a Solan goose asleep. So satisfied do the naval authorities appear to be with her exploits, that we may expect electric launches to play a very important part in future operations of the kind.

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THE Institute of Medical Electricity has experienced a quite unexpected check to its contemplated procedure, and from a quarter from which it had every right and reason to anticipate support rather than hindrance. But the Institute should progress and succeed even without the sanction and support of the august body which has not yet seen fit to countenance it. There is much good work to be done; the public needs instruction, and charlatans cry aloud for exposure. The difficulty will be to expose them in such a way that they will not reap the profits of extra publicity; they are unscrupulous in their advertising tactics, and may be counted upon to make a determined fight to turn any and every attack to their own advantage. Then, if electricity is the wonderful curative agent which it is alleged to be when properly applied, such an institution as that with which Mr. Lant Carpenter and Mr. Laurence are associated should be the means of demonstrating the fact.

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THE United Telephone Company is improving. This is a result, no doubt, of the severe criticism to which the company and its methods of doing business have been subjected by the financial and the electrical Press. A little while ago the company surprised everybody by doing what the provincial companies have done almost from the first, that is, providing all-night and Sunday service in the suburban districts. This was an advance; but a still further step in the right direction is now announced. We are to have local exchanges, by means of which the residents of suburban districts may be enabled to call up their tradesmen, professional men, and others, in just the same way that subscribers in provincial towns do. These local exchanges will be in connection with the City district, and subscribers may have the benefit of this connection by paying a fee for each conversation, or an annual sum in addition to the £10 subscription for the local service. A beginning is to be made in the Kensington district, and we suppose this will be regarded as an experiment, upon the success of which will depend the establishment of further exchanges east, west, north, and south.

## THE HAMPTON WICK RAILWAY ACCIDENT.

IT is with regret we have to chronicle another serious railway accident, one which, however serious in itself, might have been attended with still more disastrous consequences had it occurred at an hour when the trains were loaded with passengers. From our daily contemporaries the facts of the case will have become fairly well known; and, pending the inquiry which is now taking place, we have no desire to comment upon it beyond a mere statement of those facts.

From what has transpired, it would appear that a heavy bank holiday business having been fairly disposed of, shortly after midnight on the 7th inst., a train of empty coaches was standing at the signal box of the Kingston station preparatory to being placed away for the night, the road, as it is termed, having been made for that purpose. The driver of the engine serving the train being engaged, the stoker at this moment informed the signalman that the engine had to return to Twickenham to bring on the Kingston portion of a down train, the regular engine for which was, presumably owing to pressure of traffic, told off for some other duty. The signalman, apparently forgetting that he had made the road for disposing of the train, at once started the engine, only discovering the fact that he had dispatched it on the wrong road when too late to stop it. Nor would it appear that the driver or his mate noticed they were running on the wrong road till too late to avoid the collision which followed. Speeding on to accomplish their task, their attention would seem to have been devoted more to the mechanism and other duties more particularly applying to the engine itself than to the road they were on. The engine had been duly signalled as though it were running all in due course. The assumed road was clear; the signals were off, and there was nothing to indicate that they were on the wrong road, rushing into calamity.

The distance to the adjoining signal station was short; a train was at the moment approaching that station upon the same line from the opposite direction. Apparently, had a signal to "stop all trains" been made to that station from that at which the engine was dispatched all might have ended well, but this would not appear to have been done, possibly for want of time, the two signal stations being so close together. The up engine and the down train came into collision.

The accident is one which in the first instance goes far to impress one with the fact how much men called upon to perform certain duties, practically the same day after day, become mere machines, mechanically going through their work, possibly sensible at the moment of what they are doing, yet doing it so mechanically as to give it no thought or consideration. The men in charge of the Kingston signal box were men of experience, having signalled trains in and out of the station for years. They were steady, good men, from all report, and probably none on the line would have been thought less likely to commit such an error as that which occurred.

If this is so, then naturally comes the question, how is it possible to avoid such mishaps? Unfortunately, although, happily, not always attended with casualty, the case under review is not singular. Others of a like character have occurred within the year. We have but to turn to the Board of Trade reports to find that such is the case. Something certainly is needed, or there will be a sharp awakening some day. That something, if we mistake not, will be found in interlocking the electric with the mechanical signals. We have no desire to prejudge the case, but it does appear to us that, with signals and points interlocked, and the electric block signals also interlocked with the starting or home signals, it should not be possible for a man to take a wrong road without, of course, utterly disregarding his signals. It is probable that we shall again return to the subject; in the meanwhile, whatever may be the issue of the inquiry, we venture to hope, if the question of interlocking is, as we imagine, likely to prove of service in preventing such occurrences, it will not be lost sight of.

## INVESTIGATIONS ON DRY ELEMENTS.*

By H. VON BILLING.

IN the same proportion as the application of electricity is extended on the large scale for light and for the transmission of power, it becomes also more generally used on the small scale not only in permanent installations, as for signalling in houses, but in portable arrangements. We may mention as instances, signals for intercommunication, automatic breaks and blockage arrangements, telegraphing from moving trains, the examination of lightning conductors and of cables, the ignition of torpedoes, mines, and batteries of cannon at sea, and lastly, the very portable appliances of field telegraphy.

In all such applications it is required to construct sources of currents which can be easily transported without danger of disturbing the current, *i.e.*, such where the exciting liquids are not liable to be spilt, the vessels broken, the clamps oxidised and the salts to effloresce. Further, in all cases elements are desirable which need little superintendence.

The attempt has been made to meet these demands by the construction of so-called "dry elements," and a great number of materials have been already applied for this purpose. Thus, Bagration prepared elements in which a solution of sal ammoniac was absorbed in earth; Minotto used for the same purpose and at the same time as diaphragm a layer of quartz sand. Sawdust has been repeatedly proposed, as also cellulose, the latter by Wolff of Nürnberg, Keiser and Schmidt. D'Arsonval used animal charcoal, Desruelles glass-wool and also, as many others have done, fibrous asbestos. Trouvé devised elements for field telegraphy in which the interval between the electrodes was filled up with discs of blotting paper, saturated respectively with sulphates of copper and zinc. Reynier caused the exciting liquids to be absorbed in "coffer dam," a pulverulent mass prepared from the husk of the cocoa nut. Others, again, such as Schüler, Gassner and Beetz, filled up elements with gypsum, to which oxide of zinc was added for the alleged purpose of reducing the resistance. Burstyn uses in a similar manner gypsum, chloride of calcium and gun cotton.

Recently an attempt has been made to use gelatines or glues for dry elements. Edelmann manufactures elements in a pocket form, using pieces of paper steeped in a solution of gelatine and sulphate of copper. Pollak proposes a mixture of glycerine-gelatine with the exciting salts. Raoul Guèrin, of Paris, constructs elements with "gelosine Raoul Guèrin," a vegetable jelly, made from agar-agar, a vegetable mucus which forms the main constituent of the well-known eatable nests of the salangan swallow. In this jelly the usual salts are dissolved, so that a portion remains in suspension.

The statements as to the slight resistance of dry elements in general and of gelatine elements in particular, were the reason why, at the suggestion of Professor James Moser, I took up the explanation of these striking statements.

The object of the first experiments was to determine the resistance of gelatine mixed with the solutions of salts. For this purpose polarisation was eliminated according to the usual manner. The resistance of one portion of a liquid column was obtained as the difference of the resistances of two liquid columns, the difference of which formed the portion in question. As this could not be effected with gelatine in the ordinary manner, vessels were formed of several wooden frames of equal internal section but different thickness, by pressing on plates of a corresponding metal, so that the resistance of two such vessels was measured and the difference of the resistances corresponded to the difference of the thicknesses of the two vessels. From these measurements it appeared that, *e.g.*, the resistance of a gelatine disc of $8 \times 4$ centimetres in section and one centimetre in thickness, prepared with solution of blue stone, was about two Siemens units,

* *Zeitschrift für Elektrotechnik.*

whilst that of a similar column of the same solution of blue stone was only one, *i.e.*, half the resistance.

In order to carry out also experiments as to durability two equal Leclanché elements were made up, each of a cylinder of manganese carbon and a zinc rod, and one of them was charged with an ordinary solution of sal ammoniac, and the other with "gelosine Guerin," in which sal ammoniac was dissolved according to the inventor's receipt. (For this receipt and for the gelosine itself, I am indebted to the kindness of Herr Kareis.) Here it appeared, in full contradiction to the assertions in question, that the resistance of the gelosine element was *greater* than that of the water element, and that the alleged decrease of resistance in the gelosine element ensued likewise in the water element, the cause being probably the imperfect moistening of the carbon at the beginning of the experiment.

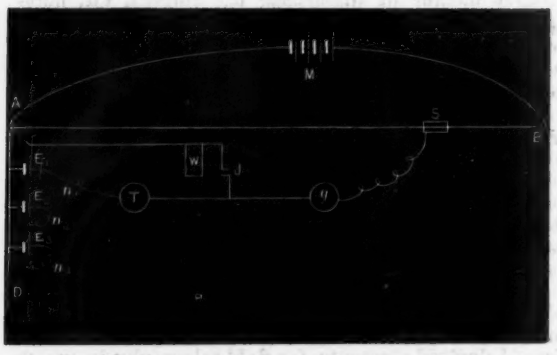


FIG. 1.

For the sake of further comparison, eight Léclanché elements, each of one manganese-carbon (briquette) plate (4 × 8 centimetres of active surface) and a zinc plate at the distance of 2 centimetres were charged, four with gelatine and four with water, and so that the four corresponding pairs received each 10, 20, 30 and 40 per cent. of the solvent. In order quickly to measure the constants of these elements when permanently connected by a known resistance (1 Siem. unit), I combined three known methods of measurement, as shown in diagram, fig. 1.

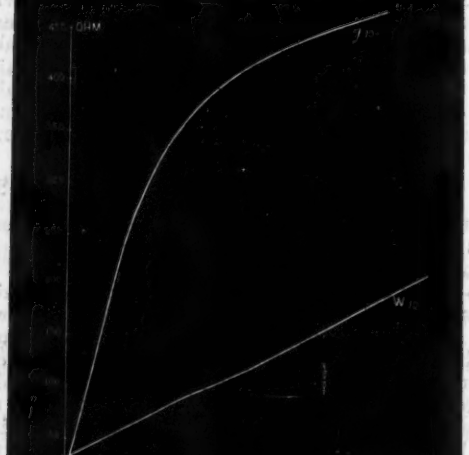


FIG. 2.

M represents the measuring (compensation) battery, A B the sliding wire; S, the slider, and G, the galvanometer of the ordinary compensation method, $E_1$, $E_2$, $E_3$, &c., being the elements to be compared, the carbon poles of which are permanently connected with A, by the thick wire, D. They were generally closed by nickel silver wires, $n_1$, $n_2$, $n_3$, &c., of the resistance of 1 Siem. unit as is to be seen at $E_2$ and $E_3$. For the purpose of measurement the corresponding nickel silver wire (as in $E_1$) was simply applied to the tangent galvanometer, T, and when at a certain position of the slider, S, the galvanometer came to rest, whereby, in connection with the preliminary compensation of the normal Daniell the electromotive power of the element was to be found, the slider according to a method proposed by Dr. Moser, was placed at the half of the piece of wire existing between A and S, the key, J, was closed, and in the rheostats, W, so much resistance was inserted that the galvanometer stood again at 0. The resistance inserted

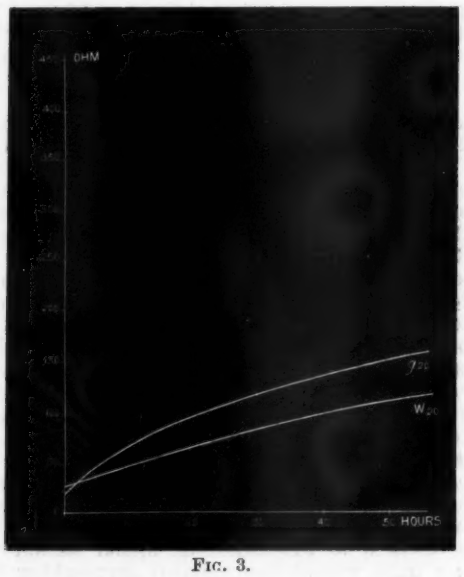


FIG. 3.

in W is then equal to the resistance of the element sought for as a reduction of the potential difference to the half of its original value can be effected only by closing the element with an equal resistance. Thereupon the slider was lifted off and the resistance in W brought to 0, so that we can read off the strength of the current by means of the graduated tangent galvanometer, T, and thus check the former measure. As a

FIG. 4.

matter of course, regard being had to the small constancy of the Léclanche element, the elements during measurement can be closed only momentarily with any other than the constant resistance of 1 Siem. unit.

The results of the measurements of resistances are the curves, figs. 2, 3, 4 and 5. G signifies an element

filled with gelatine, and W one with a watery solution, the accompanying number giving the percentage of sal ammoniac. The high absolute value of the resistance is occasioned by the small surface of the elements examined.

From the curves it appears that with the exception of some initial values the resistance of the gelatines is always greater than that of the watery solution and rises more rapidly than the latter, as also that the resistance diminishes with increasing concentration. The element, G 30, forms an exception, as during its examination there occurred a fracture of the carbon and consequently an imperfect contact.

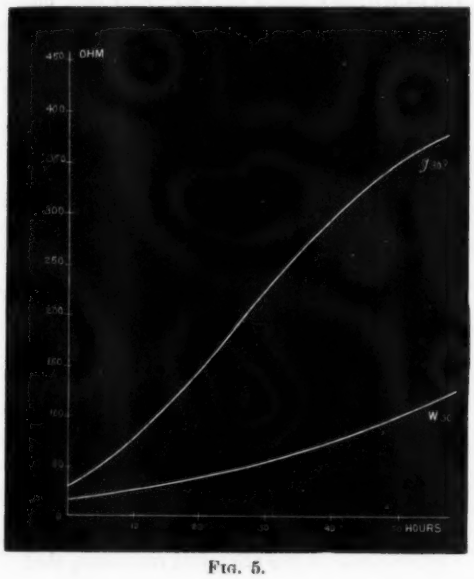


FIG. 5.

The electromotive force of the elements did not differ essentially, and in general there was recognised merely the law of concentration currents that a higher potential corresponds to a smaller concentration.

In these researches certain defects were perceptible, the obviation of which will certainly prove a remunerative problem for practical men. Thus many gas bubbles attached themselves to the electrodes, especially to the zinc plate, pushing away the gelatine from the plate and thus diminishing the effective surface. The gelatine is also very readily torn away from the electrodes in consequence of contraction if not prevented by frequent application of water, which involves a very careful examination of the elements. Sometimes there occurs also, probably by the development of bacilli, a partial decomposition and liquefaction which makes the signification of the element as a "dry element" illusory. In any case, to hit the correct proportions of gelosine, water and the salt, in spite of the best receipts, involves many difficulties and requires practice.

The chief advantage of the element is this, that the salts can be suspended in the jelly in excess, so that they may dissolve as required close to the electrodes, instead of the more concentrated part being as usual at the bottom. However, the solution is rapid enough to prevent the rise of the resistance only if the closing of the circuit is intermittent.

Guèrin uses his gelosine also in a granulated state, in which it takes up very much water. This combination, however, was not examined, as it does not form a homogeneous jelly.

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**Bank Lighting.**—The Bank of England have now determined to make a still further extension of the electric light, and have instructed Messrs. Drake and Gorham to put down two additional engines and extra battery power. It is hoped the new installation will be ready for this winter's lighting.

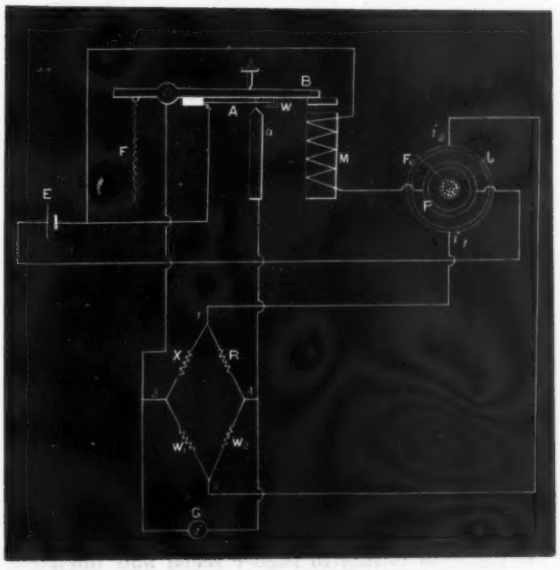
## NEW METHOD FOR MEASURING THE RESISTANCE OF ELECTROLYTES.

By J. C. PUERTHNER.

IN measuring the resistance of electrolytes the alternating currents of an induction apparatus are employed in order to avoid polarisation. If the Wheatstone bridge method is used, either an electro-dynamometer or a telephone must be applied in order to recognise the absence of a current in the bridge. If a telephone is used, as it is generally the case, we cannot judge from its sounds whether the variable resistance must be increased or diminished. It can also never be brought to silence, which adds greatly to the difficulty of the measurement, and involves an inaccuracy of some per cents.

Without renouncing the above-named advantage of alternating currents, these and other defects (physical weariness and isolation of the observer in case of a telephone) may be avoided if we allow the electrolyte and the other branch resistances to be traversed by alternating currents, but divide any currents present in the bridge into direct and inverse induction currents by the aid of my apparatus, thus obtaining currents of one direction, as may be proved galvanometrically.

This arrangement is shown in the accompanying figure. For the complete avoidance of polarisation induction currents of equal intensity and duration are produced not by interruption, but by short-circuiting the primary conductors. The apparatus for effecting the insertion and removal of the primary bobbin, as well as the separation of the induction currents, consists of a beam, B, to which is applied a spring, A, insulated below and placed as closely as possible to the beam. This beam is not in conductive connection with the beam when no pressure is applied to it, and it is connected with one pole, E, of the primary source of the current. The contact, *a*, is connected with the other pole, and the electro-magnet, M, and the inducing coil, P, are directly connected with both poles of the element.




In the position of rest, B touches the screw, *s*, which serves merely to limit the height to which it may be raised. The circuit is closed by the electro-magnet and the primary coil, in consequence of their direct connection with the poles of the element. The electro-magnet attracts the keeper, and in its downward movement the spring, A, reaches the contact pin, *a*, thus short-circuiting the primary current, the electro-magnet and the inducing coil being thrown out of circuit. The counter action of the spring, F, effects an opposite movement, withdrawing A from *a*, re-introducing the primary coil

and the electro-magnet into circuit, when the same process is repeated.

The one end, *i*, of the induction bobbin, J, is connected with 1, and the other end, $l_2$, with 2; hence the alternating current traverses the branches, X, R, $w_1$, and $w_2$, in which X represents the resistance to be measured, R the rheostat, and $w_1$ and $w_2$ the relative resistances.

In order to separate any currents existing in the direct connection of 3 and 4, 3 is connected with the beam, B, and 4 with the contact column, *a*.

When the spring, A, touches the column, *a*, and the direct induction currents come into existence, A is slightly pressed in, and there ensues a closing of the circuit of the induction coil by the beam and the contact pin which is traversed by the direct currents.

In the opposite movement the conductive connection between A and B first ceases, and when A leaves the contact pin whereby the inverse induction currents are generated, the induced current is already interrupted by the beam and the contact, and the by-circuit, N, N, remains as a conduction for the inverse currents in which is introduced the galvanometer, G.

From the deviation of the needle it may be seen whether an increase or a decrease of the variable resistance is required, a point which cannot always be at once ascertained, even on using an electro-dynamometer.

In measurements of the resistances of certain electrolytes, executed in the laboratory of the Imperial and Royal University of Vienna, it resulted that more accurate results could be ascertained, and that in a shorter time than by the employment of a telephone.

In a similar manner the measurement of the resistance of electrolytes can be effected according to the method of substitution, the decomposable conductor, and afterwards the rheostat, being intercalated in the alternate current circuit of the induction coil, whilst the galvanometer is placed in a circuit traversed only by currents of one direction.

In measuring the resistances of electrolytes by means of the differential galvanometer, the conduction proceeding from one end of the induction coil is divided into two branches. Into one of these we introduce the electrolyte and into the other the rheostat.

In order to obtain in each branch induction currents of one direction traversing both coils of the differential galvanometer, the separation of the direct and inverse currents must be effected separately in each branch, for which purpose the author's apparatus (described in the *Zeitschrift für Elektrotechnik* for 1888, Part III., p. 142, fig. 1, may be used with a suitable modification of the connection of the beams and the contact pins.

## WHAT IS ELECTRICITY?"

EXTRACT FROM ADDRESS BY PROF. A. E. DOLBEAR.

THESE material benefits that flow from the utilisation of electricity to supply our wants, and that mark an epoch in our history, are not the only benefits we have received. The work of the world must be done, and the more of it we can make the inorganic energies do for us to supply our pressing needs, the more leisure we shall have to devote to higher social and intellectual interests. In his essay on "The Praise of Knowledge," Bacon asks, "Is there any such happiness as for a man's mind to be raised above the confusion of things, where he may have the prospect of the order of Nature?" "Shall we not as well discern the riches of Nature's warehouse as the benefit of her shops?" "Shall we not thereby be able to produce worthy effects, and to endow the life of man with infinite commodities?" He then declares that "all the disputation of the learned never brought to light one effect of Nature before unknown," and that "knowledge itself is more beautiful than any apparel of words that can be put upon it," and that the "sovereignty of man lieth hid in knowledge." These good things have come to us as the fruits of knowledge, and in turn they have been the seed of knowledge. Others of the so-called forces of Nature are limited as to the phenomena which they can produce. Gravitation can only pull. Chemism arranges molecules. Heat tends to separate molecules, and so may be made to do work, but electricity is Nature's jack-of-all-trades. It not only does errands, but can attract and repel, make heat and light and magnets. Can cause molecules to combine and can separate them, it can write and talk and paint, sharpen a needle and turn a crank, roar like a volcano, and both cure and kill you. Of course, an agency having such various functions excites our curiosity and challenges our intelligence for an explanation. Who has not asked the question, "What is electricity?" To-day we are better able to answer this question than any one forty years ago was able to answer the similar one, "What is heat?"

Through the labours of Faraday, Mayer, Joule, Helmholtz, and some others, we have come into possession of a body of generalisations, the evidence for which, though not demonstrable, is overwhelming, because it is cumulative. This is what is known as the conservation of energy. Briefly this may be stated to be, first, that physical energy is a product of two factors, matter and motion; and second, that the energy of the universe is a constant quantity. The latter proposition comes from our chemical experience that whatever changes a mass of matter may undergo it is never annihilated and never increased in quantity, and therefore all the various phenomena exhibited by matter are due to the various kinds of molecular motion which it may have. Even the so-called properties of matter are explainable as due to it. There have been theories in the past that electricity is a fluid, or two fluids supposed to be imponderable, but nowadays no one thinks that it is a fluid in any sense. In a battery it is proportional to the chemical reactions, that is the molecular changes.

As the matter is not changed in quantity, it follows that the changes must be changes of motion. In a thermopile the motion provided is that vibratory kind called heat. In a common electrical machine, so long as the crank is turned the electricity is generated at the expense of the motion, not of the material of the machine. In like manner in a dynamo and in every other case. As Rowland has said, "It begins in matter and ends in matter, and must be a property of matter." But electricity never appears except when motion of some sort is spent upon two different kinds of matter, or upon matter in two different physical states. In the battery there must be two elements, in the thermo-pile two metals, in the dynamo there is a difference in molecular stress in different parts of the magnetic field, and so on, from which it follows that if there was but one kind of matter in the universe there could be no electricity; and, second, that the phenomenon called electrification is due to the molecules being thrown into abnormal positions and the propagation from molecule to molecule by contact of this same abnormal position constitutes what is called a current of electricity. Heated matter loses its temperature by a process called radiation, a kind of motion in the ether. Radiant motions take place in straight lines, and unless there be molecules in their path they will continue on for ever unless there be a boundary to the universe. The ether changes neither the direction nor the character of the rays. An electrified mass of matter depends almost altogether upon the character of other bodies in the vicinity. Some can absorb these rays, or lines of force as they are more generally called, and thereby they become electrified, and this process is called electrifying by induction as distinguished from electrifying by conduction or contact. The velocity of propagation of this action in the ether is found to be the same as for light, showing that a disturbance in the ether travels with a velocity that does not depend upon its origin but upon the property of the ether to transmit motion. Again, when heated matter loses its tem-

perature by radiation, the vibratory molecular motion is changed into an undulatory motion in the ether, a transformation in the kind of motion as well as a transfer to another medium, and it is not correct to speak of heat rays. The ether is never heated, no matter how much energy there may be in it. Similarly the inductive lines or rays from an electrified body represent transferred electrical motion, and such effects of electricity ought not to be confounded with electricity. One difficulty that has been felt by many about the fluid hypothesis or any other has been on account of the dual character known as positive and negative. That difficulty may be made to disappear by considering the character of the motion to be of the nature of a rotation. Imagine an endless rope as representing an electric circuit. At any point in it let it be twisted by the hands. It will be seen to have a right-handed twist travelling in one direction and a left-handed twist in the opposite direction, and each through the whole length of the rope, both co-existing without interference, yet nothing but simple rotation can be seen at any particular point. Call the right-handed rotation positive and the left-handed negative and you have both an analogical phenomenon and the nomenclature. There is then no necessity for assuming either a fluid or anything more mysterious about electricity than there is about heat. These dynamical principles are not only a distinct gain to science, but they are of such a character as to give delight to the thoughtful man as a part of Nature's warehouse of which Bacon speaks. They give to one the prospect of the order of Nature and add to the sovereignty of man.

## MAKING THE TELEPHONE USEFUL.

THE use of the telephone in London has, so far, says the *Financial News*, been confined almost entirely to business men. To the average housewife it remains a scientific instrument, the arcana of which she knows nothing. The United Telephone Company, rousing itself from its slumbers, has taken the problem up. The result is the establishment of what we hope will only be the first of a series of district or domestic exchanges. Kensington has been chosen as the locality for the first experiment, and the area includes the whole of Kensington proper, Earl's Court, Brompton, Chelsea, Knightsbridge, and part of Notting Hill. The idea of a "domestic" exchange is that the doctors, tradespeople and others with whom it is desirable to be in close communication in a private house are generally within a comparatively limited area. Thus it is possible, without touching upon the whole district covered by the London telephone system, to give valuable facilities to residents in a particular neighbourhood at a comparatively cheap rate. The rent of a telephone connected with the Kensington Exchange will be £10 a year, which is not excessive.

The services to be performed for this payment are considerable. Of course, the value of the local exchange will depend wholly upon the number of persons who take the benefit of what it offers. But, even as it is, a subscriber starts very well, for there are 140 telephone wires belonging to the Metropolitan system which run into the Kensington Exchange, and with these the £10 subscribers are entitled to connect. With the prospectus of the local exchange is printed a classified list of these subscribers, showing that already many of the best-known tradespeople in Kensington and round about may be called up by a £10 subscriber. A local subscriber may speak to the Irish Exhibition or to the Attorney-General, to the Alexandra Hotel, or to Fulham Union, to the Siamese Legation or the Italian Exhibition, to the Duc d'Aumale or Mr. W. S. Gilbert. Then the fire and police stations and cabstands are to be at the command of the district subscribers, who are also entitled to be put on to the local telegraph offices for the transmission by telephone of telegraph messages under the usual conditions. Thus, to start with, the facilities at the disposal of the possessor of a Kensington local telephone are considerable, and their value must increase with the addition of every new subscriber.

The only point in connection with this experiment which is distinctly open to criticism is the rate charged to local subscribers for conversation with a member of the metropolitan system. Sixpence for three minutes is an excessive charge. In the provincial exchanges threepence enables a non-subscriber to talk for three minutes, and where a man is already paying £10 a year to the United Telephone Company sixpence is too much to charge for a temporary extension of his privilege. Representations to that effect have already been made, and no doubt will receive consideration. The prospectus mentions that "should any subscriber, after a trial of the local exchange, desire to commute this fee payment, he can do so on a further payment of £10, making £20 per annum, and so have the full benefit of the London metropolitan exchange system." Surely some provision should have been expressly made for the case of City subscribers whose houses may be within the area of the local exchange, and who may wish to be able to speak between their offices and residences. There is an existing arrangement, we believe, which makes a reduction on the second rent, and it would be only fair to put in force a similar arrangement for the benefit of those who might for business purposes be £20 subscribers and for domestic reasons £10 renters. If these two suggestions be taken into consideration at Oxford Court, no doubt the certain popularity of the Kensington Exchange would be enhanced and still further assured. One strong point in favour of the scheme is that the local exchange is to be open day and night, Sundays and holidays included; which, as doctors, cabs, or firemen may be required at any moment, is of no little importance.

## LIGHTNING.

By S. A. VARLEY.

(*Continued from page* 160.)

I NOW propose to examine briefly statical charge, energy, and the relation of the earth to statical and dynamical electrical phenomena, and afterwards to make a few comments on Professor Lodge's experiments.

None of the theories give a very satisfactory explanation of statical charge, and until we know more respecting the real nature of electricity we can scarcely hope for one.

I confess to a certain mental reaction in favour of the Franklinean theory, but it appears to me nevertheless that statical charge, on the whole, is more understandable on the supposition that what we are in the habit of terming positive and negative electricities are two distinct entities.

Franklin's hypothesis assumes the pumping out of electricity on one side of the dielectric and its accumulation on the other side, producing a sort of reorganisation or re-arrangement of the sum total of the atoms and forces which go to make up what we term matter, and in this way bringing about a strained condition.

Now we are only cognisant of electricity and energy as associated with matter, and we cannot readily grasp the term energy in any other sense than as implying activity; and if energy be motion, then to talk of it as being in a statical condition seems to be a contradiction of terms. We can, however, with less mental difficulty realise energy being balanced by energy, and thus bringing about a condition of equilibrium.

We have an example in a revolving disc, where matter is subjected to force in such a way that the energy exerted throughout the matter composing the disc is in opposite directions. Now, although a rotating disc is not an explanation, it is an illustration that helps us forward in the direction of an explanation of statical charge.

In a revolving disc we have motion imparting energy to the molecules of the disc tending to separate them one from the other; but at the same time, the disc, as a whole, is in a condition of equilibrium, and

behaves like matter at rest in reference to external forces, such as gravity, &c.

As the disc has been subjected to a single force, and force is indestructible, the energy imparted cannot dissipate itself by discharge, and the disc continues to revolve, the energy dissipating itself gradually in the form of heat produced by friction at the bearings and the skin resistance of the atmosphere.

Were the energy, however, of a dual character, we could imagine the disc being brought suddenly to a state of rest by the union of the two forces, accompanied by a rapid dissipation of energy such as we have experience of when a Leyden arrangement is discharged.

The query suggests itself: Can statical charge be looked upon in the light of a storage of energy?

Maxwell has stated: "The total energy of any material system is a quantity which can neither be increased nor diminished by any action between the parts of the system, though it may be transformed into any of the forms of which energy is susceptible."

Accepting the above definition, the phenomena of energy must be attributed to a temporary shifting of the energy forming part of the system; and if a Leyden jar be regarded as a complete system, then statical charge may also be regarded as a production of energy of position, or storage of energy, or more correctly, perhaps, as an approach to it, for we have in the case of the statically charged jar internal forces displaced but not removed, and the organisation of the matter composing the Leyden arrangement is not actually altered, but only tending to be so.

If we place two platina plates in a cell containing water, or acid and water, we shall form a Leyden arrangement with a dielectric of very low resistance, the liquid taking the place of the glass insulator. Now if we statically charge this arrangement by connecting the positive and negative poles of a galvanic battery to the platina plates there will be not only a displacement of the forces, but an actual breaking down and partial reorganisation of the atoms composing the dielectric, and an approach to their union with the platina plates.

In this example we have a statical charge, or storage of energy, of a much greater quantity than is possible with a Leyden jar, but as the dielectric is one of very low resistance the potential to which it can be charged is proportionally low. Nevertheless, the storage of energy under such conditions will necessarily be very limited, for, although an actual breaking down and separation of some of the atoms of the dielectric has occurred, the separated electrically charged atoms do not possess sufficient energy to break down the organisation of the platina plates, and so form an actual union with them. Consequently they accumulate as a statical charge only, and by their reaction resist the further breaking down of the atoms of the dielectric, but if sheets of oxidised lead be substituted for the platina plates a breaking down and reorganisation of the atoms, both of the dielectric and of the lead, will be brought about, and the storage of energy now possible is consequently immensely increased.

What we have seen occurs in a limited degree with platina plates immersed in acid and water when electrically polarised, and what occurs in a very much greater degree in storage batteries explains what electrical energy is striving to bring about in the matter composing a Leyden jar, and helps us to understand the nature of statical charge.

In a storage battery electrical energy produces a very similar condition in the leaden plates to such as we find to exist in fulminating compounds, gunpowder and organic matter, in all of which we have matter and force locked up together, and in a condition of more or less unstable equilibrium.

I have now step by step linked together statical charge, electrical polarisation, storage batteries, explosive compounds and organic matter, much in the same way as in a previous portion of this article I have indicated the successive links in the chain which connect the action of gravity on matter with the production at the end of the chain of electrical energy, and I would here point out that if there be a difficulty in comprehending the nature of a statical electrical charge, it is equally difficult to understand how energy can be confined in gunpowder or organic matter, and I would further point out that the energy given out by a storage battery is very different from the energy directly produced from organic matter or explosive compounds, and the only thing they have in common is that when energy is dissipated, whatever be its source, such dissipation always assumes the form of heat.*

Electricity and energy are so intimately related, that it seems necessary to say a few words on the subject of energy.

Scientific progress may be said to be directly proportionate to the accuracy of our knowledge of the forces the scientist has to deal with, and great advances can scarcely be expected to be made by microscopically examining scientific phenomena separately, and simply measuring them.

To make important progress, it is necessary to leave the beaten track travelled over again and again by scientific schools, and to seek some elevated standpoint outside where one can look down upon matter and its associated forces as a whole.

If we seek such a standpoint, one of our first observations will probably be that matter and force form a mysterious duality.

There is abundant evidence of force being locked up in matter, but not a single example of force isolated from matter; we may therefore almost safely assume as axioms the following propositions:

1. As we have evidence of force being confined in matter, and never find it separated from matter, that matter is the home of force.

2. That as force cannot be separated from matter, where there is no matter there can be no force.

3. That as the existence of force involves the existence of matter wherever force is exerted through what is termed space, be it the action of the earth's magnetism on a compass needle, or the radiations from the most distant of the stars, the energy received must have been transmitted through a medium of some sort, and if the above three propositions be admitted, it follows as a corollary that our solar and stellar systems float in an ocean having properties in common with matter; but when the mind tries to grasp what must be the nature of this medium, or ether, as it has been termed, it is confronted with what seems to be an insoluble problem, for it becomes necessary to conceive the existence of imponderable matter, in other words a peculiar kind of matter in which the distinguishing characteristics of matter, viz., weight and inertia, are absent. Mathematicians seem to be able to grasp the conception of such a medium, and Sir W. Thomson has attempted to give a popular illustration of it by means of two illustrations. The first illustration assumes it to have the property of a stiff jelly, which will allow a ball inserted in it to oscillate backwards and forwards, but not to pass through, because the jelly is a solid; the second illustration assumes it to have in a very refined degree the properties of pitch which, though brittle and solid, possesses the property of fluidity, and will allow a denser body to pass through. Now although the phenomena of electricity and magnetism not only require for their explanation the assumption of a continuous chain of matter, but seem, also, to demonstrate as clearly as anything can be demonstrated the existence of such a chain, still it is impossible to understand the existence of a medium having positive and negative properties at one and the same time, and therefore I cannot regard the ether theory otherwise than as a sort of Athanasian creed occupying the place it does in the absence of more complete knowledge.

When force is transmitted by a dynamo driven by a steam engine we have energy unlocked in the fire grate

* I assume there is no such thing in the strict sense of the term as dissipation of energy; what is termed dissipation of energy is a local dissipation only.

partly transformed in the boiler, and completely transformed in the steam engine, directly to the amount of mechanical force produced and expended in the production of electrical motion in the armature coils and conductor, and also in overcoming the magnetic inertia and maintaining the magnetic polarisation of the field magnets. We see, here, there is a series of transformations before the heat energy becomes converted in electrical energy, and the fact of this series of transformations intervening has raised the doubt in my mind, which has been expressed in an earlier portion of this article, whether there is such a thing in a strictly true sense of the term as the conversion of one force into another.

There is a wonderful parallelism and harmony in all the phenomena of nature, and in this comparatively advanced period everything produced by labour is, in a sense, a form of energy ; the production of a picture, or the making, say, of a chair, involves labour, and the picture and the chair are the compliment or balance of the energy expended, and which was obtained from the consumption of food, but it can be scarcely said that the picture and the chair have locked up in them any of the forces which were stored up in the food eaten. Now the chairmaker and the artist cannot directly obtain from their respective productions the energy expended in producing them, but through the convenient medium of money they can do so ; and, in the case of the artist, not only can he obtain stored-up energy to the amount consumed, but he can obtain a great deal more, because he is an advance on ordinary matter and possesses something approaching to creative energy. In an earlier period of the world's history, when trade was carried on by exchange and barter, the invention of money was as great an advance as the determination of the mechanical equivalent of heat in our own day, and the man who invented it was the Joule of his period, as his discovery enabled the multitudinous forms of human labour to be dealt with in terms of energy. The possession of gold gives a man energy of position, which is really the same thing as what we call storage of energy.

In the labour market 1 lb. of gold may be said to have about thirty times the energy of the same weight of silver, and 1 lb. of silver about 100 times that of copper.

How suggestive this is of the atomic weights of the material elements which vary so much. The atomic weights are, after all, only an expression of the relationship of elementary atoms to electrical and chemical energy stated in terms of their relationship to gravity, and it was the want of harmony here shown between gravity and electrical energy in their action on matter which suggested the doubt whether gravity and electrical force could possibly be protean shapes of a common principle, and which the conversion of one form of energy into another form of energy seems to assume.

I wish now to say a few words in reference to the earth considered as a conductor, for, as shown by the correspondence which crops up from time to time in the ELECTRICAL REVIEW, as well as electrical literature, the views entertained by some electricians would appear to be somewhat hazy ; for example, in Culley's work, the text-book adopted by the Postal Telegraph Department, there is the following passage :—" It was at one time imagined that the earth completed the circuit precisely in the same manner as a return wire ; this opinion is now considered incorrect."

When a young man I made the discovery, or I thought I had, that all true science could be explained by common sense reasoning, and that when a so-called scientific explanation did not harmonise with common sense, then such explanation might be suspected of being unsound. Huxley, who is happy at phrases, has expressed much the same view by describing science as disciplined common sense.

I am of opinion that Huxley's dictum is sometimes overlooked by scientists, and that the extract I have made from the text-book of the Postal Telegraph Department is a case in point. Why should the earth be an exception to other electrical conductors. I think it may be safely asserted that although similar results are often brought about by very different methods, Nature never performs the same operation in more than one way, for example, the various types of dynamos all develop electrical energy in a similar manner, and animals and insects possessing sight see all of them through optical organs resembling one another and acted upon by light in a precisely similar way, and when the earth forms part of an electric circuit why should electricity follow another law in this part of the circuit ?

In papers published 30 years since in the transactions of the Institution of Civil Engineers and Society of Arts, I described among other things the relationship of the earth to the insulated wire of a telegraph circuit, and also to statical electrical phenomena.

I also described in what way submarine circuits differed from overground ones, and I called attention to what older electricians knew under the name of absorption of charge, which I said might be considered as an approach to conduction. I mention this because it has since been christened electrification, and Fleeming Jenkin credited with the discovery of it.

I pointed out what was scarcely appreciated in those days, that the tension, or as it would now be called the potential of a current where it entered the insulated wire of a telegraph circuit would be limited by the total resistance of the circuit, and adding to the number of battery cells would not in a circuit (whose resistance was so small as to be a negligible quantity) practically increase the potential, and I stated that the earth owing to its great mass relatively to an insulated telegraph wire might be regarded as a conductor having no resistance, and consequently the potential would be infinitely small and practically the same in every part of this portion of the circuit.

I said the prime conductor of a frictional machine formed one coating of a Leyden arrangement, the air, the dielectric, and the earth the other coating, that the only difference between it and an ordinary Leyden jar was that as the surface of the earth was immensely larger than that of the prime conductor, and as the positive electricity on the one surface was balanced by an exactly equal quantity of negative electricity on the other surface, the potential on the larger surface was less than that on the smaller surface directly as their difference of area and where as in this case the earth formed one of the coatings the potential of the electricity accumulated on so extensive a surface was so small as to be inappreciable. I mention this because certain consequences follow from what I then pointed out which I think are not appreciated even at the present time.

In those days it was very generally considered that the transmission of currents through an underground circuit followed an altogether different law from that which governed conduction in suspended circuits. I urged it was impossible to believe that nature had one law for an insulated suspended wire and another one for submerged and underground circuits, and I stated that the only difference between them was one of degree. I further stated that although the accumulation of statical charge in a suspended circuit was when compared with that of a submerged conductor so small as to have been generally overlooked. Still it was there, and could be seen, that I had obtained very decided indications of it in a suspended wire of 60 miles in length, using an ordinary lineman's galvanometer, and that with more sensitive instruments it could undoubtedly be seen on much smaller lengths.

I pointed out that although a submarine circuit had been considered to be similar to an ordinary Leyden arrangement there was *practically* a very great difference between them. I stated that it was well understood that induction involved insulation, and that where there was no insulation there could be no statical charge, that the insulation separating the inner and outer coatings of a Leydon jar was the resistance of glass, whereas the insulation separating the inner and outer coatings of a submarine circuit considered as a Leyden arrangement was the resistance of the copper

conductor only, the inner coating of the Leyden arrangement, and connected through the circuit of the telegraph instrument by a metallic conductor to the outer coating, viz, the salt water of the ocean.

Now this was quite overlooked by our leading scientific men, including Professor W. Thomson and even Faraday, until after I had pointed it out. Snow Harris had stated that induction decreased as the square of the resistance separating two conductors, but I suspected the truth of this law, for the reason that electricity was not a radiant force but a dual one, and that wherever there was free positive electricity, there must be in its neighbourhood an equal amount of negative electricity, and this was irrespective of any difference of surface there might be in the two conductors between which the induction occurred, and as a result of series of experiments carried out at the time when I was writing my paper, I found induction followed the same law as conduction, decreasing between flat plates directly as the distance separating them, or, to put it in another way, if a Leyden arrangement, which we will call No. 1, be constructed of two metal plates separated by a dielectric, say $\frac{1}{10}$th of an inch thick, and a second similar arrangement be constructed with a dielectric of $\frac{2}{10}$ths of an inch, No. 1 will have twice the storage capacity of No. 2, or to state it differently, if in No. 1 arrangement 20 units of electricity were necessary to electrically charge the plates to a potential of 10, only 10 units of electricity would be required to raise No. 2 to the same degree of potential.

There is another experiment I tried at this period, and repeated more carefully a few years later. I mounted on a cylinder of annealed soft iron, 6 inches long and $\frac{1}{2}$ inch in diameter, two wooden discs about $6\frac{1}{2}$ inches in diameter. I then wrapped two layers of No. 18 B.W.G. insulated copper wire immediately on the iron core, counting the number of convolutions; after this I wrapped the bobbin with string to a diameter of 6 inches, and outside the string I wrapped two layers of the No. 18 wire, counting the number of turns, so as to be sure there was the same number of convolutions in each set. The length of the insulated wire of the outer convolutions was approximately 12 times that of the convolutions of smaller diameter, and the mean distance of the outer convolutions from the centre of the iron core was approximately 12 times that of those wrapped immediately upon it.

I joined the convolutions of insulated wire in series, but so connected them that the electricity circulated when the battery circuit was closed in opposite directions through the two sets, and I found when I closed the circuit there was not the slightest trace of magnetism produced, thus showing that an electric current flowing through a circuit whose length was 12 and whose distance from the centre of the iron core was 12, had the same magnetising influence as a conductor whose length was 1 and whose distance from the centre of the iron core was 1 also.

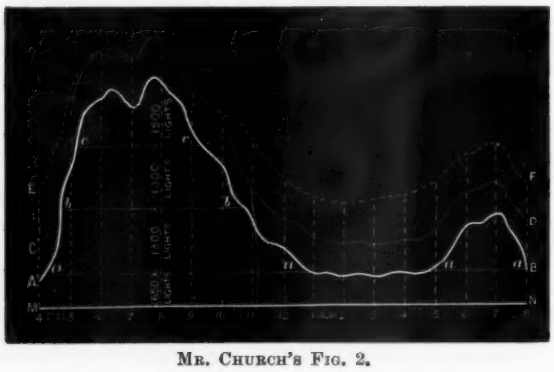
I wish now to point out certain consequences arising out of these experiments, but these must be deferred to the continuation of this article in next week's REVIEW.

(*To be continued.*)

## HIGH AND SLOW SPEED ENGINES.

THE able paper read at the late convention of the National Electric Light Association, at Pittsburgh, by Mr. Wm. Lee Church (see ELECTRICAL REVIEW for April 13th, 1888), writes J. A. Powers, C.E., in the New York *Electrical Engineer*, suggests some points in the relative coal economy of high and slow speed engines which it is believed are not fully nor fairly treated in that paper. That the experience of Mr. Church in the making, testing, and using of high speed engines, leads him to the conclusion that the independent high speed engine is the best in average coal economy in incandescent light stations, because the stations which he cites as users of large engines are less economical of coal than other well-designed stations using high speed engines is no proof that high speed is a better economist than slow speed, even for the variable loads of incandescent light stations. The great variety of boilers, settings, and draft appliances, and in the quality of fuel in use render any comparisons of coal consumption valueless, except as a general index of possible results. The only fair way to state the general problem is to make a distribution of the steam consumption, which would be about as follows:—

*First.*—Steam loss by radiation, and used for boiler feed and in providing water supply, &c. This will con-



MR. CHURCH'S FIG. 2.

stitute a certain nearly uniform amount per day for any given plant when under steam.

*Second.*—Steam consumed in engines, as shown by indicator cards.

It is this second item with which we are concerned, as the first will be an individual factor for each station.

We should then consider the nature of the loads imposed on the power plant in every electric light station, and then deal fairly with the problem. These loads are:—

1. Friction.—*a* consists of friction of engines in use; *b*, friction of shafting in use; *c*, friction of dynamos and belting in use.

2. Effective load; power required for conversion from mechanical to electrical energy, including the losses in conversion output.

It will be evident that the "friction" load in the case of independent engines will be a nearly uniform percentage of the electrical output at any time, providing each engine is loaded to about its fair capacity, while in the case of slow speed engines there will be a certain constant quantity introduced, viz., the friction of the engine shafting and dynamos necessary to be run whether without load or not when certain dynamos are in operation. This is a consequence of the inflexibility of the shafting system, and we must, therefore, under light loads pay a penalty of a larger percentage of friction to load than with independent engines, and this will entail an extra coal expense. The question of the coal economy of the two systems, therefore, depends on whether the slow speed can save enough coal when under heavy load to more than counterbalance the losses by friction under light load.

It is not to be presumed that any sane man will design a station for such a loading as Mr. Church shows in his diagram No. 2, to be run by a single engine large enough to handle the entire load. No steam engineer would consider the idea of handling the lightest loads—say, from 60 to 75 H.P.—with an engine of 400-horse capacity. The necessities of any but the smallest station call for a divided engine plant. If the question of reserve power be left out, a station of 400-horse might be properly provided with one engine of 100-horse and one of perhaps 300-horse, both slow speed if desired. If the smaller engine be a high speed the station will be on the same terms as a station with exclusively high speed engines during the hours of light loading, which would

limit the question of relative coal economy to the hours of heavy loading—say, from 4 till 11 p.m. and 5 to 8 a.m. The arrangement for such a plant should be to drive each engine to a section of shafting conveniently arranged to give each engine its separate shaft and dynamos. These sections may be coupled by a friction clutch when desired, and friction clutch pulleys should be used for the driven pulleys from the engines. The dynamos may be provided with loose pulleys on the shaft or with some kind of belt holder to enable the dynamo to be stopped without interfering with the line shaft. The dynamos may be belted in opposite directions in pairs when space will permit, so as to reduce friction to a minimum.

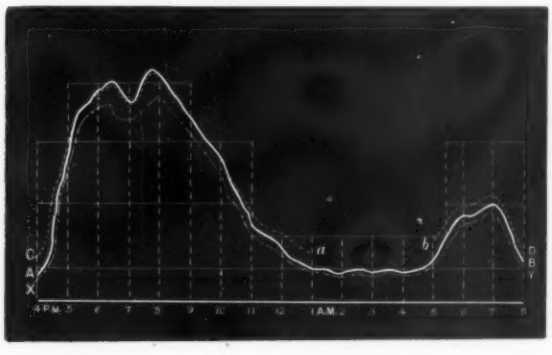
Now, in comparing the relative friction of the two systems the friction of dynamos may be neglected, since any dynamo may be stopped as soon as its load is taken off, in either system; in one case by stopping an engine, in the other by shifting a belt. This brings the question of friction down to whether the friction of large engines and shafting exceeds that of small engines alone.

The friction of high speed engines is variously stated by engine builders at from 5 to 8 or 10 per cent. of full load. Probably the latter figure is not far from the truth, and if it were too large a percentage for full loading it must be remembered that a minute subdivision of power would be required to bring this about, and that this is neither practical in cost of investment nor of operation, and that a reasonably divided power plant will not ensure high speed engines always working on full loads. The percentage of friction will be greater under less than full loading, since engine friction seems to be nearly constant for all loading, in well designed engines.

Mr. Church states that shafting and engine friction ranges from 12 to 20 per cent. upward, and not infrequently rises to 30 per cent. This may be possible, but it certainly is not so in all cases, and if we allow the same skill in designing a slow speed station which some of Mr. Church's show, it is entirely unnecessary. Indicator diagrams from a 20 × 48 Corliss engine driving 16 feet of $3\frac{7}{8}$ shafting at 320 revolutions, one 50-light Thomson-Houston 1,200 C.P., and one United States 20-arc light dynamo, out of circuit, showed a total of $14\frac{6}{10}$ H.P., and deducting 3 H.P. for the dynamos, leaves $11\frac{6}{10}$ H.P. for friction of engine and line shaft, or $5\frac{8}{10}$ per cent. if the engine be rated at 200 HP. This would indicate the engine friction to be as low as 3 per cent. The same engine driving 17 feet of $4\frac{7}{8}$, and 33 feet of $3\frac{7}{8}$ shafting with pulleys, but without belts, showed $22\frac{1}{2}$ H.P., or 9 per cent. for engine and shafting. If the dynamos are belted in pairs, with belts pulling against each other, there will be no increase of their friction under load. A slight increase under load may be expected from the extra strain of the main engine belts under load; but a fair outside limit of 10 per cent. for engine and shafting friction may be taken from these data.

Now, in the diagram shown of the load of an incandescent station, Mr. Church says that the heavy lines, A B, represent the fluctuation of the *actual load*, such as would be determined by indicating a series of independent engines, and the area enclosed between it and the base line, *m n*, may be denominated the net power required. This presumably includes the engine, belting, and dynamo friction of the high speed engine. Then Mr. Church proceeds to saddle all the sins of the high speed system on the slow speed system by saying: "The fine irregular line, *c d*, encloses the gross load when driven by a single large engine, being equivalent to the *net load* plus the friction of the shafting and pulleys required in transmission;" thus assuming that the net load is the *indicated horse-power* of the high speed engines, entirely ignoring the frictions which are chargeable to that system.

Now let us take some liberties with Mr. Church's diagram. We have reproduced his heavy line, A B, of gross loading as shown by the indicator on the high speed engine plant. From this line is constructed a new curve, shown in broken and dotted line, which is obtained by deducting from the ordinates to the curve, A B, the 10 per cent. of friction chargeable to the high speed system. This new line, X Y, is the true line of net power, and it is from this line that we must construct our friction curve for the slow speed system. This curve, C D, will be found by laying off a line above the curve, X Y, and distant from it 10 per cent. of the maximum power in use. The diagram now shows simply the power used in driving the entire station, and does not consider the coal economy of the engines, which in Mr. Church's diagram is charged up against the slow speed system in the curve, E F, and is not considered in the high speed




curves at all. It will be noticed that this slow speed power curve, C D, nearly coincides with the gross power curve, A B, of the high speed system during the times of heavy loads, and that it rises above it as the load becomes less. The station is supposed to be operated by starting the 300 H.P. engine at 4 p.m. and supplementing it with the 100 H.P. at 5 p.m., then dropping off the 100 H.P. at 9 p.m. and starting it again at 11 p.m., shutting down the large engine at the same time. At 5.30 a.m. the 300 H.P. would be started and run till 8 p.m.; the 100 H.P. going out of service at 5.30 a.m.

We have now to consider the steam economy of the various types of engines, in order that we may discuss intelligently the relative economy of the two systems. The following is a summary of the statement of engine builders on the point:—

| | Lbs. steam per H.P. hour. |
|---|---|
| High speed engines of 50 to 100 H.P. | 28 to 32 lbs. |
| Corliss engines of 200 to 400 H.P. | |
| Single cylinder, high pressure | 24 to 26 lbs. |
| " " Condensing | 20 to 21 lbs. |
| Compound, condensing | 15 to 16 lbs. |

These results would give with an evaporation of eight pounds of water per pound of coal,

| | Coal per H.P. hour. |
|---|---|
| High speed | 3·50 to 4·00 lbs. |
| Corliss single cylinder, high pressure | 3·00 to 3·25 lbs. |
| " " " Condensing | 2·50 to 2·62 lbs. |
| " Compound condensing | 1·87 to 2·00 lbs. |

These results do not vary much from good practice for the Corliss engines, but the departure is very wide from the ordinary results in the case of the high speed type. A central station operator of great experience informed the writer not long since that he allowed six pounds of coal per arc lamp per hour as an average result. This would not be less than six to seven pounds of coal per horse-power hour for engines of 50 H.P. The experience of the writer goes to prove that this result is about correct for engines of that size. For 100 H.P. engines a result perhaps one pound better can be had. The results recently shown in changing some stations from high to slow speed seem to indicate the correctness of these results, one such case reporting a saving of 50 per cent. in fuel. Another case where a 20 × 48 Corliss was substituted for three 50 H.P. high speed the results were fully as good, though the Corliss engine was a part of the time under a very light load. The most curious result is that this engine is sometimes run under a load of 125 H.P. during a dark day in place of the 50 H.P. engine which ordinarily carries a

day load of 60 H.P. and actually carries the heavier load with the same coal though the Corliss engine works at only half load, while the 50 H.P. was but slightly overloaded, and at a comparatively economical point of cut-off. This is a comparison of much value in considering the relative merits of the two systems, since the indications are that the Corliss engine is more economical even when under half loading than the 50 H.P. high speed engine is at a fair load.

Now let us consider the comparative coal consumption of the two systems on the power curves we have laid out in diagram No. 2. The planimeter shows between the base line and the power lines.

| | |
|---|---|
| A B ... ... ... ... ... | H.P. hours 3,300 |
| C D ... ... ... ... ... | |
| 4 to 11 p.m. ... ... ... | |
| 11 p.m. to 5 a.m. ... ... ... | |
| 5 a.m. to 8 a.m. ... ... ... | 3,580 |

If these quantities are multiplied by the proper coal rates we have :—

| | | |
|---|---|---|
| High speed A B, 3,300 × 5 lbs. ... | | = 16,500 |
| Slow speed, C D. | | |
| High pressure... ... | 3,300 × 3·25 | = 10,750 |
| Condensing ... ... | 3,300 × 2·62 | = 8,646 |
| Compound condensing | 3,300 × 2·00 | = 6,600 |

These results show savings as follows :—

| | Saving. |
|---|---|
| High pressure Corliss ... ... ... ... | 5,750 lbs. |
| Condensing ... ... ... ... | 7,854 „ |
| Compound condensing ... ... ... ... | 9,900 „ |

over the high speed engines at 5 lbs. coal per horse-power per hour.

Now the Corliss engine will not, of course, be working on an economical loading during part of the time, but in order to get an extreme comparison let us suppose that the Corliss system is run at full power whenever in use at all, or in other words, that the coal consumption is the same whether the engine is partly or fully loaded. I do not believe that the most ardent advocate of the high speed system will claim that a Corliss engine will burn *more* coal under light load than when fully loaded.

The schedule as above indicated would give the following horse-power hours :—

| | |
|---|---|
| 310 H.P., 4 to 11 p.m. ... ... ... ... ... | 2,170 |
| 5.30 to 8 a.m. ... ... ... ... | 775 |
| 125 H.P., 5 p.m. to 9 p.m. ... ... ... ... | 500 |
| 11 p.m. to 5.30 a.m. ... ... ... | 812 |
| | 4,257 |

which would give the coal consumption—

| | | |
|---|---|---|
| High speed at 5 lbs. coal per H.P. hour | | = 16,500 |
| Corliss, high pressure ... ... | 4,257 × 3·25 | = 14,835 |
| „ condensing ... ... | 4,257 × 2·62 | = 11,153 |
| „ comp. condensing ... | 4,257 × 2·00 | = 8,514 |

So that the high pressure Corliss engine is the better on coal consumption even under the *reductio ad absurdum* that there is no saving in coal as the load becomes less, and giving the high speed engine the benefit of a coal rating at full load. It will be noticed also that the coal rates taken for Corliss engine, as above are the largest rates shown by ordinary practice and makes no allowance for expert care which has its effect on all engines in saving of leakage and friction.

This discussion leads us to about the following conclusions as to the coal economy of the various types of engines, taking the high speed engine as unit :

| | Coal consumption, lbs. | Percentage, saving. |
|---|---|---|
| High speed ... ... ... ... | 16,000 | 0·00 |
| Corliss, high pressure ... ... | 11,000 | $\cdot 31\frac{3}{10}$ |
| „ condensing ... ... | 9,000 | $\cdot 43\frac{8}{10}$ |
| „ comp. condensing ... ... | 7,000 | $\cdot 57\frac{2}{10}$ |

This is believed to be as fair a statement as can be shown from the average practice. These results speak for themselves. We must use condensing engines wherever possible, and to do this we must locate near a plentiful supply of water. If no stream or pond is convenient we must try driven or artesian wells. Both have proved effective, and location must determine the choice. The saving by condensing is not less than 25 per cent. under full loads, and one-quarter of our coal bill will pay large interest on any reasonable expenditure to obtain water supply.

First cost of steam plant is a matter of importance in station construction, and may be fairly stated about as follows for the different types of engines.

| | |
|---|---|
| One 100 H.P. engine high speed ... | $1,500 to $1,800 |
| „ 200 „ Corliss „ ... ... | 4,500 „ 5,000 |
| „ „ „ „ condensing ... | 5,200 „ 5,800 |
| „ 350 „ „ comp. condensing | 13,000 „ 14,000 |

If we add shafting to the cost of the last three engines we shall have a cost per horse-power—

| | Cost per horse-power. |
|---|---|
| 100 H.P. high speed engine ... ... ... | $15 to $18 |
| 200 „ Corliss high pressure ... ... | 30 „ 32 |
| 200 „ „ condensing ... ... ... | 33 „ 36 |
| 350 „ „ comp. condensing ... ... | 45 „ 48 |

This is as far as the high speed advocate usually goes, but it is not far enough. If we need less steam we require less boiler capacity, and this reduction will be nearly in proportion to the coal rates of the different types of engines. A well set boiler of 60 inches diameter by 17 feet long with good draft will supply steam for three 50-H.P. engines, but will need forcing to do it. The same boiler will supply a 20 × 48 Corliss condensing engine of 250 H.P. much more easily.

We may fairly state the cost of steel boilers well set, as required by the different systems, about as follows :

| | |
|---|---|
| 100 H.P. high speed ... ... ... | $16 to $18 per H.P. |
| 200 „ Corliss ... ... ... | 12 „ 14 „ „ |
| 200 „ „ condensing ... ... | 10 „ 12 „ „ |
| 350 „ „ comp. condensing ... | 7 „ 9 „ „ |

So that the total cost of steam plant will be about as follows :

| | |
|---|---|
| High speed ... ... ... | $31 to $36 per H.P. |
| Corliss ... ... ... ... | 42 „ 46 „ „ |
| „ condensing ... ... | 43 „ 48 „ „ |
| „ comp. condensing ... | 52 „ 57 „ „ |

Now let us compare our results of first cost and saving together,

| | Cost per cent. | Coal consumption, per cent. |
|---|---|---|
| High speed ... ... ... | $1.00 | 100 |
| Corliss ... ... ... ... | 1.31 | 62 |
| „ condensing ... ... | 1.36 | 56 |
| „ comp. condensing ... | 1.62 | 44 |

and with coal at $3 per ton on the above schedule and interest at 6 per cent. the results will be for the 400 H.P. station under consideration—

| | Cost of coal per day. | Saving in coal over high speed. | Interest per day on 400 H.P. | Loss in interest. |
|---|---|---|---|---|
| High speed ... ... | $24.75 | 0.00 | 2.36 | ... |
| Corliss H.P. ... ... | 18.90 | 5.85 | 3.08 | .72 |
| „ condensing ... | 15.24 | 9.51 | 3.15 | .79 |
| „ comp. condensing | 11.64 | 13.11 | 3.75 | 1·39 |

Or in a 400 H.P. station the high-pressure Corliss engine beats the high speed system $5.13 per day, Corliss condensing $8.72, Corliss compound condensing $11.72.

It may be said that these figures are theoretical to some extent, but they will be found to agree pretty closely with the results of good practice for both systems.

It is to be noted that a number of stations lately laid out contemplate the use of Corliss engines, in part at least ; and some of them from the plans of the best engineers we have.

The writer hopes to supplement this paper with a statement of some accurate tests on engines of each type, at an early date.

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**A Synthetic Study of Dynamo Machines : Correction.**—In article II. page 146, the arrows showing the direction of the induced currents in positions 2 and 3, fig 14, have been inadvertently drawn in the wrong direction. In both cases the current looking at face *c* should flow in the direction of the hands of a watch.

## WHAT DOES IT ALL MEAN?

[A COMMUNICATION.]

ABOUT six years ago, when electric light companies were being launched so quickly and so carelessly, many experienced men, who ought to have known better, only too willingly lent them their assistance. It is no wonder, then, that inexperience in the anxiety to be foremost in the race gave all its attention to the trimming of the sails and none to the ballast, so that the first breeze of adverse criticism capsized and wrecked the ship, causing nothing but consternation and confusion in every direction.

Many millions of money had been paid by the British public for English and foreign patents in the great desire then prevalent to become a shareholder in the electric light companies whose prospectuses gave forth such fair promises of success and future wealth as made those experienced in such documents stand aghast at their audacity.

It is said that patentees and schemers, more especially foreigners, heartily ridiculed the childlike credulity of the English people in regard to electric light companies. This is not surprising, for never since the "South Sea bubble" burst had there been such an epidemic among the people. Advice was disregarded as they thoughtlessly rushed forward to take up the shares which were sown broadcast in their midst.

Things were in this state when the Telegraph Construction and Maintenance Company appeared upon the scene, being hailed by all right thinking men as "guides, philosophers and friends." For was it not an understood thing that they would first ascertain the practicability of the plan submitted to them, and if they adopted it they would give no fancy price for the patents; they would find suitable premises for the experiment, but no money.

On these conditions a syndicate was formed, and the system of Mr. J. E. H. Gordon, who had had little experience, but whose patented ideas seemed worthy of a trial, was chosen, to be carried out under his personal supervision.

The *Times* of October 28th, 1882, after commenting on illuminants generally, says, with reference to the use of one large machine for the purpose of electric lighting, instead of a number of small ones :—

"To this point Mr. J. E. H. Gordon has for long past given considerable attention, and he has designed and constructed a dynamo-electrical machine for this special purpose. This machine has been in successful operation for more than a month past at the works of the Telegraph Construction and Maintenance Company at East Greenwich.

"At these works a large party of electricians and other gentlemen interested in electric lighting assembled on Wednesday evening to inspect the machine and its working. The explanations respecting the machine and its working were given by Mr. Gordon, from whose designs, and under whose supervision, the machine was constructed and the lighting carried out. To that gentleman belongs the credit of having perfected, made, and worked the largest dynamo-electric machine in existence. Its total weight is about 18 tons, the weight of the revolving magnet wheel being seven tons, and its diameter 8 feet 9 inches. The ground space occupied by the machine is 13 feet 4 inches by 7 feet. The number of revolutions is 140 per minute, which gives a speed of rather more than 60 feet per second to any point in the periphery of the revolving wheel. The machine is driven by an engine of the locomotive type, indicating 150 horse-power, and it is excited by a pair of small Bürgin machines running at about 800 revolutions per minute, and driven by a small horizontal single-cylinder engine. In the Gordon machine the magnets revolve and the coils are fixed. This method of construction possesses two important advantages. In the first place, it enables the revolving wheel to be made of wrought iron boiler plate and strong enough to transmit any quantity of horse-power that the machine is capable of absorbing. In the second place, it dispenses with the necessity for rubbing contacts, except for the feeble current which excites the magnets. There would be very great difficulty in taking the current for the large number of lamps this machine will supply through a rubbing contact spring. The machine is stated to be capable of supplying the current to 6,000 Swan incandescence lamps of 20 candle-power each. Owing to the large diameter of the magnet wheel (8 feet 9 inches) the required velocity of the magnet at the rim is obtained by running the machine at the comparatively low speed of from 140 to 200 revolutions per minute. This low rate of speed obviates the necessity for belts, counter-shafting, or other intermediate gearing, and enables the dynamo to be coupled direct to an engine of ordinary construction, running at an almost ordinary speed. In this machine there is absolutely no sparking or any other visible electrical indication that the machine is at work producing a splendid current. This current is an alternating one, and therefore suitable only for electric lighting and not for the transmission of power.

"The whole of the works of the Telegraph Construction and Maintenance Company at Greenwich are now brilliantly lighted by the current from this machine. These works are 476 yards long and 14 acres in extent, and so may, for the present purpose, be considered as a model town, for they contain streets, workshops, and private houses, all of which are brightly illuminated by 1,350 Swan lamps of 20 candle-power each, the current being conducted to them through an aggregate length of about eight miles of wire, large and small. For the exterior lighting four of these lamps are placed within an ordinary lantern, but Mr. Swan is at present engaged in making some lamps of higher power for this purpose. For interior illumination the 20 candle-power lamps are used singly or in pairs or clusters, as circumstances may require. After inspecting the machine and its working, the visitors were conducted successively through the telegraph cable core factory and serving room, the lower and upper stories of the cable factory, the tank room, the cable testing room, the offices, the stores, and the dwelling-house, the whole of which, together with the out-door avenues, presented an excellent example of soft, yet bright and steady, electric lighting. During the inspection it was shown that any lamp or any number of lamps could be turned on or off independently of the others, just as might be desired. The engine power used is regulated from the photometer room in exact accordance with the number of lamps lighted. In this room are indicators showing the electric pressure, the steam pressure, the speed of working, and the brightness of the lamps. The man in charge of the machine stands in the room, having at his command hand-wheels which enable him to regulate the supply of steam to the engines exactly as required. For instance, if at the far end of his district 100 lamps are turned out, his indicators at once apprise him of the fact, and he diminishes the supply of steam accordingly. No 'resistances' are used to compensate lamps cut out of circuit, the work expended being simply decreased by the regulator.

"The reason why the machine is only being worked at about one-fourth of its actual power—that is, only lighting 1,350 lamps instead of 6,000—is that there is no necessity for a greater supply of light to the works. A larger engine will, however, probably be put down to drive it, and steps taken for the utilisation of the whole of its productive power. That the machine is highly efficient has been proved by careful experiments made by the company's engineers, and which have shown that when 134 indicated horse-power is being supplied by the steam engine, 94 per cent. of that power is represented in the lamps. The form in which the machine has been designed specially lends itself to the safe construction of much larger sizes. It is stated that there will be no difficulty in making machines to supply as many lights as the largest gasworks yet constructed, and that, with every increase in size, there will be a great economy in the

cost or production of light as well as in that of supervision and in other current expenses. Altogether the machine and its accessories reflect great credit on Mr. Gordon, whose theoretical conclusion is that it will be possible to supply electric light on a large scale at the same price as gas, and to realise a good profit thereby. So far as the very practical tests to which this machine has been and is now being put have gone, they justify that conclusion and tend materially to confirm it."

This system of lighting was to be used at Greenwich until sufficient data had been obtained to enable the Telegraph Construction and Maintenance Company to decide whether or no they would proceed further. We will take it for granted that the results were satisfactory, as the company at length opened an electric light department of which Mr. Gordon was appointed manager, and eventually what is known as the "Paddington installation" was commenced.

When this installation was completed, which was only done after difficulties which we will not now stop to consider, many of those interested in electric lighting were invited to inspect the result. On that occasion the *Times* gave the following favourable report:—

"The first practical example of electric lighting from a central station by direct current has just been completed at Paddington in connection with the Great Western Railway. The installation is the largest yet accomplished in this country, and was inspected last evening by a large party of scientific gentlemen. The installation has been undertaken by the Telegraph Construction and Maintenance Company to test the practicability of central station lighting. The district lighted comprises the Paddington passenger and goods stations and the hotel, the locomotive station, the Royal Oak and the Westbourne Park stations, all the offices, yards, and approaches to the various stations, and the line of the railway itself from Paddington to Westbourne Park. The district is 1½ miles long and covers 67 acres of ground. The engine house is a short distance from the terminus, and the electric system is that of Mr. J. E. H. Gordon, the manager of the Telegraph Construction Company's electric light department. There are three Gordon dynamos, of which two work and one is held in reserve and is always kept slowly revolving ready for use at a moment's notice. The dynamos weigh 45 tons each, and are wound to give a pressure of 150 volts. When all the lamps are on the machines give about 2,000 ampères each. Each dynamo is driven by a compound tandem engine of the vertical inverted cylinder type by Rennie, and capable of indicating 600 horse-power. The dynamos are coupled direct to the engines, belts being dispensed with. The magnets of each of the large dynamos are excited by a Crompton direct current machine (the Gordon machines producing alternating currents) driven by a Willans engine. The main dynamos are driven at about 150 revolutions per minute. A double system of mains is laid throughout, and every precaution is taken to insure safety from the accidental extinction of any of the lights. The light is distributed by 4,115 Swan glow lamps, each of 25 candle-power, by 98 arc lamps, each of 3,500 candle-power, and by two arc lamps, each of 12,000 candle-power. The total light is thus equal to that of about 30,000 ordinary gas jets. Every lamp has a separate switch, so that it can be turned on and off independently. The glow lamps are entirely under the control of the users and not of the suppliers, just as in the case of gas. The current is on day and night, except for three hours in the daytime on Sunday, when it is interrupted for testing purposes. The installation thus approximates to a house-to-house supply of electric light, and it has worked successfully in every respect since it was started on the 21st of April last. The visitors first inspected the engines and dynamos, and were afterwards taken down the line to the various stations and sheds and back to Paddington Station, the whole installation being most perfect in every detail, and reflecting every credit on the contractors."

At a general meeting of the Telegraph Construction and Maintenance Company held in March, 1887, the chairman, Sir. D. Gooch, said: "With reference to the electric light at the Paddington Station, the alleged nuisance which its working caused was still the subject of litigation. Of the efficacy of the light the director's had no doubt." In the July of the same year, at the half-yearly meeting of the same company, at which Sir George Elliott, M.P., presided, in the absence of the chairman of the company, Sir D. Gooch, through an accident, the chairman, in answer to a question, said "he believed the directors had under their serious consideration how far the experiment with the electric light, which they had already made for the Great Western Railway Company, could be utilised for developing the business of the company."

The Paddington installation being completed to the apparent satisfaction of Mr. Gordon, he strongly recommended the Telegraph Construction Company to undertake new installations; but this it would seem the majority of the directors declined to do, not viewing the success in the same light as Mr. Gordon, for the company suddenly closed the electric lighting department; dispensed with the services of its manager, and prematurely closed their engagement with the Great Western Railway Company.

Sir D. Gooch being chairman of both the Great Western Railway Company and the Telegraph Construction Company, it was only fair to assume that he knew all about the Paddington installation, and that at the next annual meeting of the latter company he would mention the subject; he did not do so, however, and therefore many of the shareholders still remain ignorant as to how matters stand, and from what cause so fair a promise of harvest has been so suddenly blighted.

Those who were thus left in ignorance must have felt greatly disgusted when so soon after leaving the service of the Telegraph Construction Company Mr. Gordon, in a discussion at a meeting of Telegraph-Engineers, repudiated his former system in the following words:—"If I may be pardoned in putting into a scientific discussion a word almost of autobiography, I would say that I am not altogether incompetent to speak on the development of alternate current machines, for I suppose few people have been so deeply committed to them as I have been, or have had to deal in actual practice with such large ones; and yet I lately, even at the expense of abandoning every patent that I hold, have been so far convinced of the superiority of the method of distribution given by storage batteries that I felt compelled to abandon what was identified as my own system." Mr. Gordon also said: "We are now busy with our Whitehall installation." It is not difficult to learn who comprises the "We" from the prospectus of the "Metropolitan Electric Supply Company," a company just formed, of which Mr. Gordon is a director, as also is the managing-director and one of the directors of the Telegraph Construction Company. The prospectus does not state who is to do the actual work as no mention is made of either engineer or electrician (we all know what "consulting" means), nor is it set forth what system is to be employed nor how many directors form a quorum for business purposes.

At the discussion referred to it was said that "Jerry Builders and Cheap Jacks" had done much to retard the advancement of electric lighting; this may be possible, but there are we think more serious causes which might be given.

Children are sometimes told to shut their eyes and open their mouths then they will know what good things they have had sent them. An insinuating way of gaining knowledge doubtless, for children, but in more mature cases we recommend all as a rule to keep shut their mouths, and wide open their eyes, then it would not so frequently be necessary for them to ask, What does it all mean?

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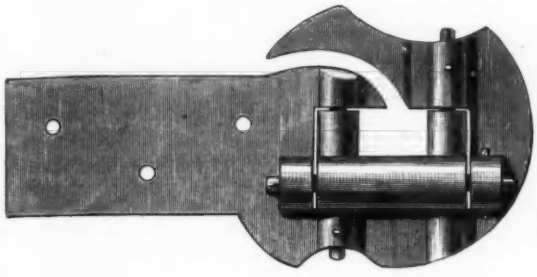
**United River Plate Telephone Company, Limited.**—Application has been made to the Stock Exchange Committee to appoint a settling day, and to grant a quotation to the furthur issue of 5,000 shares of this company, Nos. 50,001 to 55,000.

## GILBERT'S ROLLER DEVICE FOR THE RENEWAL OF AERIAL LINE WIRES.

THIS novel device, an outline of which was given in the REVIEW of March 23rd, is the invention of Mr. Arthur E. Gilbert, electrician to the Highland Railway Company.



As the illustration (a side view) shows clearly the arrangement, and the subject having already been before our readers, any further explanation is unnecessary.

The arrangement seems well adapted for the intended purpose. The rollers, we may mention, are made of "Delta" metal.

## A GALVANIC GENERATOR.

IN the ELECTRICAL REVIEW for January 7th we showed very clearly that a famous "electropathic" belt which emanated from the house of C. B. Harness & Co. was, electrically speaking, inoperative. Our article was very warmly commended by several esteemed technical contemporaries both in England and abroad and was also favourably noticed by a portion of the medical press. Still, so far as the latter is concerned, there is a display of apathy in connection with all this galvanic belt quackery which to us seems most unaccountable, as journals devoted to medical purposes could do far more towards stamping out the evil which now exists than such a periodical as the REVIEW, which, however, does not object at times to go somewhat outside its special province if any particular good is to be served.

In keeping with the promise made in our last week's issue we illustrate a galvanic generator which, so far as ignorance of the most elementary knowledge of electricity is concerned, appears to us to be an advance

FIG. 1.

on even the electropathic belt. That marvellous outcome of the combined scientific and commercial attainments which the President of the British Association of Medical Electricians possesses in such a marked degree, is no doubt fresh in the memories of our readers so we need not refer to it again in detail. Suffice it to say that the "disses," when not worn outside the underclothing, a method which, however, appeared to be quite as efficacious as any other way, were supposed to generate a current when subjected to the excretions of the skin, and that the two metals were absolutely short circuited externally by being connected together by pieces of copper wire. The electrical arrangement of the belt was bad enough in all conscience, but the apparatus under notice is still further removed from what we should expect to find in any intelligent attempt at constructing a galvanic couple for giving a "gentle shock" to the human system. But like the razors of old these articles appear to be made to sell, and it is sad to think how many of us have been sold.

Fig. 1 shows in plan and section a thin brass case into which is fitted a circular piece of black surfaced

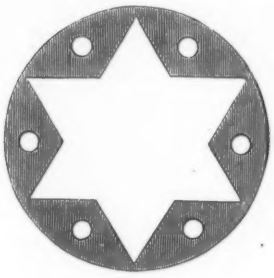


FIG. 2.

FIG. 3.

cardboard. On the top of this is fitted the elegantly shaped copper plate, fig. 2, metallically connected to the edge or rim of the brass case. Fig. 3 is a star

FIG. 4.

FIG. 5.

shaped piece of zinc, fig. 5 a piece of iron wound round with a single layer of small insulated copper wire, the object of which we have not been able to

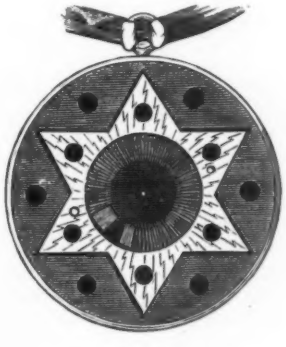


FIG. 6.

grasp unless it is to still further impose upon the understanding—or want of it—of the credulous, and fig. 4 represents the generator previous to the introduction of the zinc. The *tout ensemble* is reserved for fig. 6, which shows the full size of this magic charm. One

end of the wire coiled around the iron was, in the sample sent to us, pushed under the cardboard, and the other under the copper plate ; so case, copper plate, and wire are all in metallic connection one with the other. The zinc, moreover was at several of the angles jammed hard against the corresponding edges of the copper. The following are the directions for wearing this precious amulet :—"Tie the ribbon around the neck so that the battery may hang upon the chest next the skin. It should be worn day and night, also for several weeks after the patient is cured. Children under eight years of age should wear them in the daytime only. In severe cases of rheumatism or debility, accompanied by loss of vital power, two batteries should be worn, one on the back between the shoulder blades and the other on the chest, but in slight cases it will not be necessary to electrify the blood to such an extent. No two persons should wear the same battery."

Once again we commend this subject to the medical press. We have to a certain extent gone out of our way to preach the crusade against these bogus appliances ; Mr. Jerritt, Mr. Lant Carpenter, Mr. Lynd and others have also taken the same matter in hand very warmly, but the support of the medical profession is necessary to make any real headway in "scotching" the electropathic snake.

When members of this noble fraternity see on the advertisement sheets of the numerous vendors of quack goods who debase both electricity and the healing art by their nefarious dealings such abominable falsehoods as "universally approved by the leading physicians as the best, safest, and most effectual remedy," why do they not band together and demand in a court of law that such transparent methods of trading upon the credulity of the masses should be peremptorily stopped under penalty of imprisonment. The infliction of heavy fines would not seriously interfere with the traffic for the sums which are annually spent in advertising shows only too clearly that with these gentry money is no object. A thought has struck us that if such magazines as *Cassell's*, the *Quiver*, the *Leisure Hour*, *Longman's*, the *Sunday at Home*, the *Century*, *Harper's*, and many others of a like nature which are very extensively read in our home circles would take the matter in hand on the authority of the technical journals much good might result. There is, however, always that *bête noir* the "testimonial" to contend against, hundreds of which vendors of quack appliances can produce as evidence of the usefulness of their goods, although of course rebutting testimony could always be as readily obtained to clearly demonstrate that electricity does not enter in the question at all, faith and flannel being the real panacea. We shall continue to expose anything of a catchpenny nature so long as it is associated with the mystic term "electricity," whether we come across it either directly or through the medium of our kind friends.

## THE ELECTRIC LIGHT IN PARIS.

[FROM A CORRESPONDENT.]

THE use of electricity in every-day life in Paris is becoming more and more manifest, whilst the city is flooded with books and pamphlets on electricity.

However, the chief question of the day here, as regards electricity, is the lighting of the principal thoroughfares by the electric light. Nobody doubts for a moment that this will soon be effected, but the great stumbling block is the City Gas Company, which is working tooth and nail to resist the innovation. Its losses have already been considerable, and the directors are doing all in their power to retain custom by constantly lowering the price of gas, and even—which is not generally the case here—laying the pipes in dwellings free of charge. The gas company tried, too, to obtain the working of the electric station contemplated to be established by the city corporation, but that affair failed.

The public, as well as the authorities, who were at one time rather sceptical as to the electric light, are now gradually coming round, and begin to realise its advantages, as, for instance, the little or no danger as regards fire, its pleasantness to the eye and lungs, and its decorative effect. To this the terrible fire at the Opéra Comique has no doubt contributed, as well as the heat and smell of gas generally prevailing in Paris theatres and shops. Consequently extensive electrical plants have been introduced into the Bon Marché, the Louvre, the Printemps, as well as several theatres. Of the latter, the most extensive is that of the Grand Opera, which is lighted by 7,000 incandescent lamps inside, and some arc lamps in front. The installation here, which was effected under the guidance of Mr. Vernes, the managing director of the Edison Company, was very difficult, as the space hardly sufficed for the machinery, whilst at the same time the wires had to be laid contiguous to the gas pipes. In fact, in all new public buildings to be erected, regard should be paid to the eventual introduction of the electric light.

In order to see the present application of the electric light in Paris more generally, one need only take a walk any evening along the great boulevards. Nearly every café, theatre, or shop of note is lighted by electricity. In the cafés and shops electric incandescent lamps, sometimes coloured or shaded and gathered into tasteful bouquets, throw a beautiful light upon the objects displayed in the windows and the pavement in front, whilst the strong arc lamps outside are hardly less effective. The shops which still burn gas are in an insignificant minority. Nearly everywhere the electric light is encountered, and new plants are daily laid out. Even working tailors and bootmakers who are obliged to have a gas motor in use on their premises, apply it to a dynamo for electric lighting at night. Naturally in the larger factories and mills the electric light is already introduced, as a matter of course, and in the great tailoring establishment La belle Jardinière, all the sewing machines in the upper stories are worked by means of a powerful generator in the basement, which also supplies the electric light. It must therefore be said that the electric light is making remarkable progress in this city of gaiety.

## NOTES.

**Use of Accumulators by the Admiralty.**—Messrs. Drake and Gorham have recently supplied a battery of their special ship-lighting cells in connection with the installation on the Royal yacht, the *Osborne*, of the same size as those fixed on the *Victoria and Albert*. The advantages of the accumulators were amply shown on a recent occasion, when the plant failed owing to some accident. The same firm are at present engaged in fitting a set of their cells on board the *Britannia* and the *Hindostan*.

**Electric Lighting in St. James's.**—At the last meeting of the Vestry of St. James it was resolved, on the motion of Mr. Keevil, with respect to the electric lighting licence—(1) That no overhead wires or cables shall be placed within the jurisdiction of this Vestry. (2) That this Vestry will not approve of any concession or licence being granted to any electric light company to supply such light to this parish, unless the licence provides that after the shareholders of such company have received an annual dividend of 10 per cent., one-half the surplus shall be set aside and applied towards the funds of this parish, or in diminution of the charge for lighting by electricity the public streets. (3) That all correspondence and matters in reference to granting a concession by this Vestry to any electric lighting company shall be submitted to the legal advisers of this Vestry, to report thereon, before being finally confirmed.

**Electric Light in Maritime Warfare.**—The recent clever use of the electric light by Admiral Tryon, says the *Admiralty and Horse Guards Gazette*, recalls a somewhat similar use made by the French in their attack upon Sfax. Being unable to get near enough for an effective fire upon the forts, the French Admiral mustered his Hotchkiss quick-firing shell-guns, and, distributing them amongst his boats, sent these after dark to make the attack, moving his ships as closely as the depth of water permitted. He then threw the strongest electric glare possible upon the forts, and the boats, moving ahead in the correspondingly deep gloom, just beyond the flashes of light, came sufficiently near to pour in so destructive a fire that the defenders could not stand to their guns, and capitulated soon after daylight. The *ruse* of the blockaded squadron was equally successful, though happily bloodless, and shows how an enemy may be harassed and baffled by an energetic and skilful commander.

**Cheltenham and the Electric Light.**—At a recent meeting of the Cheltenham Town Council, the electric lighting committee reported that it was desirable to try the experiment of lighting a portion of the town with the electric light, that the area to be lighted be High Street from Hales Road to Gloucester Road, Colonnade to Lansdown, and Clarence Street to the end of Manchester Street. It was considered that 36 electric lamps, each of 1,200 candle-power, would be sufficient to efficiently light that area, and that 170 gas lamps would be rendered unnecessary. Mr. Norman strongly urged the adoption of the report, concerning which the committee was unanimous. He pointed out the advantages of the electric light, and recommended the Corporation to take the work into its own hands, rather than allow it to be monopolised by a private company. He also suggested that underground wires should be used. The recommendation of the committee was carried without opposition.

**Colliery Lighting.**—The Consett Iron Company has made arrangements for lighting the workings of Westwood Colliery by electricity. and has entrusted the contract for executing the same to Messrs. Clarke, Chapman, Parsons & Co. This, we understand, is intended as an experiment, and if it proves successful the other collieries belonging to the Consett Company will also be lighted by the same means.

**Gas Companies and the Electric Light.**—At the recent meeting of the Gas Light and Coke Company, Col. Makins, M.P., the chairman, observed that the only people, so far as his experience went, who had obtained any benefit by that form of illumination were the sellers of the machinery. "At the same time," said the chairman, "the electric light will progress, and we ought to feel no jealousy about it." He hoped, however, that the proprietors "will not be induced to throw away their stock under the influence of panic or a flaming advertisement."

**Steamships and the Electric Light.**—The extended use of the electric light on the part of the British mercantile marine is well illustrated in the case of the *Norham Castle*, one of the Donald Currie mail steamers which left London on Wednesday for the Cape. The vessel has recently been fitted throughout by the Anglo-American Brush Electric Light Corporation, and has an installation of some 320 lights. Each state room is fitted with a 16 C.P. incandescent lamp, so that a passenger can illuminate his cabin at any hour of the night by simply turning on a switch at the side of the berth. In the main saloon there are 28 lamps, arranged so as to throw a diffused and agreeable light; while the same method of illumination has been extended to the second and third class cabins and to the quarters of the officers and crew. Electricity has also been applied to the steamship's signal lamps and to a submarine lamp, by means of which the ship's hull and propeller can easily be examined. Previous to the departure of the vessel a number of guests were entertained on board, and, under the direction of Captain Robinson, inspected the ship's accommodation and fittings.

**Electric Lighting Bills.**—Owing to the lateness of the present session, the South Metropolitan Electric Supply company has dropped the Bill which sought the confirmation of a provisional order recently granted by the Board of Trade, for lighting with the electric light the parishes of St. James's, Westminster, St. Martin-in-the-Fields, Waterloo Bridge, and a portion of the Victoria Embankment. This Bill, which was the only electric lighting Bill introduced this session, had passed the examiners, but opposition had been threatened by the parish of St. James's and a competing electric lighting company.

**The Telephone in France.**—A *Standard* telegram from Paris states: The telephone line between Paris and Marseilles is complete, and at 10 o'clock M. Peytral, Minister of Finance, who is now at the latter city, conversed by telephone with M. Coulon, Director of Posts and Telegraphs in Paris. Several official personages were present, both in Paris and Marseilles, at this official inauguration of the line. The telephonic communication between these two cities will be open to the public next Monday. The charges are fixed as follows: For five minutes' conversation between Paris and Marseilles, 3 francs; between Paris and Lyons, 2 francs; between Lyons and Marseilles, 1 franc 50 centimes, and *vice versâ*.

**More Eye Openers**—A gentleman well known in electrical circles has just brought in some samples of magnetic and other appliances which are sold as charms against all maladies, and which a lady acquaintance of his was ill-advised enough to purchase. The funniest thing is a pad, which we are told is for the purpose of inducing sleep, and this we shall illustrate in our next. From an examination of its contents, it seems to us that it is quite immaterial upon which part of the body the article is worn. The other is a 33s. flannel belt, apparently of the wholesale value of eighteenpence or thereabouts, into which are sewn a lot of little pieces of what at first sight appears to be crinoline steel, "well varnished and insulated," about one inch in length. There is the faintest trace of magnetism in some of them, so it is evident that a magnetic metal has been used. One of the appliances bears the name of Darlow, the other that of Parkes.

**Telegraphic Communication between Lightships and the Shore.**—On Wednesday afternoon the Lightship and Floating Telegraph Station and Salvage Syndicate, of London, exhibited at the Council Chambers, at Dover, working models of their apparatus. Mr. H. W. Goodman, the inventor, explained the apparatus, which was claimed to be a ready means for establishing telegraphic or telephonic communication between lightships and the shore. The apparatus was simple and inexpensive, and could be fitted to any vessel and worked by an ordinary seaman. It was proposed to establish a company for working the patent. Mr. Councillor Hobbs, of Ramsgate, who has energetically advocated the establishment of electrical communication between the shore and the Goodwin Sands lightships, was also present. He advocates the linking together of the four lightships, and that cables should be laid from the North Goodwin lightship to Ramsgate and from the South Sands Head lightship to Dover. He contends that if this were done a great many lives would be saved annually and much valuable property saved. He holds that if the cables had been in existence at the time of the *Scholten* disaster the whole of the unfortunate emigrants on board her would have been saved.

**Cables Broken.**—The Eastern Telegraph Company, Limited, notified at the begining of the week, that its Aden-Bombay cables were interrupted, but that the repairing ship would be in the locality of the fault in a few days time. Until communication is restored, telegrams for India, China, &c., should be sent through the lines of the Indo-European Telegraph Company.

**Communication with India, Australia and China.**—The Indo-European Telegraph Company, Limited, notifies that in addition to the interruption of the Eastern Company's cables between Aden and Bombay, reported on the 11th of this month, one of the cables of the Indian Government between Bushire and Jask, in the Persian Gulf, broke down on the 13th inst. at noon. The Indian Government has now, therefore, only one working cable by the Indo-European route, and there is, consequently, heavy delay on messages. The Government repairing steamer *Patrick Stewart* is on her way to the fault, and the repairs are expected to be completed between the 20th and 22nd inst. The Great Northern Telegraph Company informs us that its route to the Far East is working well.

**The Pacific Cable Scheme.**—Mr. Owen Jones, one of the directors of the Canada Pacific Cable Company, and Mr. Sandford Fleming have, according to Reuter, had a satisfactory interview with Sir John Macdonald regarding both cable and steamer communication. The matter will come before the Canadian Cabinet next month on the Premier's return.

**Electric Meters.**—Can any of our numerous friends inform us whether there is a really reliable electric meter in the market to comply with the following demand? It must register in ampère-hours from 1 to 30, and not cost more than £5. If any such is obtainable we shall be glad to receive full particulars on both technical points and cost.

**Magnetising Watches.**—We shall be glad to learn of an instance of a watch having been magnetised by its owner having ridden in an electrically-propelled tramcar. Of course, a chronometer may become magnetically affected in so many ways without the cognisance of the wearer, that the primary cause of its faulty action cannot always be clearly traced, and we therefore only require information on the above-mentioned point which is absolutely authentic.

**The London Platino-Brazilian Telegraph Company.**—This company notifies that the half-yearly coupons, which fall due on September 1st, 1888, of its £100,000 Six per Cent. Debentures, will be paid by Messrs. Glyn, Mills, Currie & Co., of 67, Lombard Street, London, E.C., on and after that date; and also that coupons must be left with the bankers three clear days for examination.

**Arc Lights and Vegetation.**—It has been observed at a town in Maine, U.S.A., that an elm tree which was set out directly under an arc lamp has outstripped all other trees planted at the same time. If this is really so to any appreciable extent, says *Modern Light and Heat*, the arc light may possibly be made of use in the greenhouse. Is it possible that our American contemporary is unaware of the elaborate ancient light and heat experiments made years ago by the late Sir W. Siemens, with respect to the influence of the arc light upon plant growth?

**Legal.**—D'Arcy *v.* The Liverpool Electric Supply Association (before Vice-Chancellor Bristowe).—The Vice-Chancellor, in giving judgment in this case, already reported in the REVIEW, stated that he had personally visited the premises and found that the machinery was constructed on the most approved scientific principles, and worked remarkably well and smoothly. He was unable to detect the slightest vibration in any part of the plaintiff's house; but there was certainly a humming noise in the scullery, back parlour, and one of the bedrooms, which, however, was so slight that it could not possibly have any effect upon the business or interfere with the ordinary comfort of the occupants of the premises. Consequently he dismissed the action with costs, without, however, prejudicing the plaintiff's remedy at law in the event of the defendants causing greater annoyance and injury in the future. His honour also refused an application made by the plaintiff to stay execution as to costs.

**How to Make Money.**—A correspondent curious to know what terms were allowed to agents for the sale of bogus electro-medical appliances, received from a certain firm the information that he could purchase 13 5s. batteries for 32s. 6d.; selling these, therefore, at the nominal price enables the agent to make 100 per cent. on his investment. The agent is also supplied with 1,000 handbills, so it is easy to see that the proprietors of these goods themselves must make enormous profits. In another instance a gentleman whose name has already figured in our correspondence columns was offered 75 per cent. off the selling price of the articles, together with all advertising costs if he would consent to become the quack firm's country representative. So far has advertising been carried, that we are assured £150 has been paid for a single page in a daily paper, and as this is often repeated no further comment upon the commercial success of these undertakings is necessary. The opinions of medical men of note who have spoken well of electricity *per se* are so adroitly quoted and mixed up in the pamphlets of these gentry that most readers are led to believe that the opinions are relative to the value of the special belt or galvanic generator mentioned.

**Electrical Communication with Lighthouses.**—Sir Michael Hicks Beach presided last week at a meeting of the House of Commons Select Committee appointed to inquire into Lloyd's Signal Stations Bill, the object of which is to enable Lloyd's to acquire lands compulsorily when required for the purpose of placing outlying lighthouses and islands in communication with the mainland by electricity.

**Success of Glasgow Science and Art Students.**—The following students from Professor Jamieson's engineering classes at the Glasgow and West of Scotland Technical College have gained first-class honours at the late Science and Art Department's examinations. In applied mechanics, James Mair; in steam, N. K. Turnbull, Wh. Sch.; and John Calder, Wh. Sch.; in magnetism and electricity, Chas. H. Yeaman. Last year Mr. Yeaman was second in the kingdom in electric lighting, and this is the first time, we believe, that first-class honours have been secured by any candidate in magnetism and electricity since the regulations, set agoing three years ago, requiring those who pass in theory to appear at South Kensington laboratories and go through a practical examination in electrical testing. This year in the City and Guilds of London technological examination Mr. Yeaman obtains first-class honours in telegraphy and telephony; Mr. Fulton, honours in electric lighting and transmission of power; Alex. F. Stewart is first with the silver medal; J. L. Brown second with the bronze medal in the ordinary stage of this subject, and Gilbert A. Stewart fourth with bronze medal in telegraphy.

**Removal.**—The Bernstein Electric Lamp Company, Limited, notifies that on and after the 11th of August, its offices will be at 2, Marlborough Mansions, Victoria Street, S.W.

**Crystal Palace School of Practical Engineering.**—On the occasion of the distribution of certificates to the students of the Crystal Palace School of Practical Engineering, on Saturday last, by Mr. Arthur Thomas Walmisley, C.E., President of the Society of Engineers, the following report by Mr. Sydney Evershed, A.S.T.E., on the electrical department was read:—"The electrical section is conducted on an excellent system, by which, in addition to a thorough grounding in the theory of electricity, the students receive practical instruction in the management and working of electrical plant. The inspection and repairs of the machinery used for lighting the palace and grounds being entrusted (under supervision) to the students, they have exceptional facilities for acquiring technical skill and experience." Certificates were awarded in the elementary section of the electrical department to A. P. Crawford, and in the advanced section to H. C. Belgemann and W. Riley. The chairman, the examiners, and some other speakers,

expressed their sense of the good work being accomplished by the school, owing to the excellent method steadily pursued by the principal, Mr. J. W. Wilson.

**Technical Supervision.**—In an electric lighting specification which has come under our notice we find the following curious paragraph relative to the making of joints, &c. :—"Notice must be given by Messrs. —— (the contractors), to the clerk of the works at the building, or in his absence to whoever he may depute, at least half an hour before making each or any joint or connection to any cable of stranded wires. Such joint, or connection, between the several copper wires must, moreover, be left uncovered, so as to allow the soldering to be visible until it has been inspected by the clerk of the works or his deputy." The gentleman who presides over the building operations, and who during the course of his experience may never previously have seen any wiring operations, has the power to reject any joint or connection which *he* may consider faulty, and if he so desires it he is invested with the authority to demand a half-hour's notice to be given in the case of every joint or connection in *single* or *twin* conductors. If he carries out the terms of the specification to the very letter the work will make rapid progress, and the contractors will have much to be thankful for. One would almost think that the electrical engineer who is answerable for the above conditions had a dim recollection of having heard that once upon a time joints in submarine cables were made under the eyes of others than the manufacturers, and that it was usual to give notice of such on all important operations. Rip Van Winkle is still amongst us.

**An Electric Railway for London.**—At a meeting of the shareholders of the City of London and Southwark Subway Company, held at Winchester House on Tuesday, the directors were authorised to make arrangements for the working of the line by electricity. The subway, which, when complete, will extend from the City side of London Bridge to the Swan at Stockwell, with several stations between those two points, was originally intended to be worked on the endless-cable principle, which is said to give such satisfactory results in America, but the directors of the company have, after careful investigation, arrived at the conclusion that the line can be more thoroughly, efficiently, and economically worked by electricity. Several eminent firms have, they say, expressed their readiness to undertake the work, the system which they propose to adopt being that of continuous conductors, and are so sanguine of success that they have offered to work the line on favourable terms for a number of years. One or two of the shareholders present evinced opposition to the action of the board in discarding the original idea of a cable, for what, in their opinion, was the more risky electrical system, but eventually the resolution proposed by the chairman was sanctioned. It was stated during the proceedings that the engineer hopes to get that portion of the subway between the City and the Elephant and Castle completed by the end of the year.

**Patents for Current Regulation.**—We are informed that another important electrical patent suit has just been brought to a conclusion. This time, however, the patent has been upheld and declared by the courts to be fundamental. This refers to the suits of the Thomson-Houston Company against infringements by the so called American system and others, upon their regulator patents whereby automatic current regulation is obtained. This decision has been given in the United States, and we learn from Messrs. Laing, Wharton and Down that the result has been just cabled to them. The Thomson-Houston Company will, it is thought, probably take similar steps to protect their interests in other parts of the world.

## NEW COMPANIES REGISTERED.

**Lineff Electric Traction and Lighting Syndicate, Limited.**—Capital £10,000 in £1 shares. Object :—To acquire the letters patent, No. 8,380, dated 10th June, 1887, and No. 13,447, dated 4th October, 1887, for operating tramways or railways by means of electricity. Also to undertake in connection with any patent held by the company or otherwise, the electric lighting of roads or other public thoroughfares, or the interior of shops, houses or other buildings. Signatories (with one share each) : *Robert Applegarth (submarine engineer), 11, Queen Victoria Street ; *Alexander Login Lineff (electrical engineer), 88, High Street, Chiswick ; *E. H. Bayley, 42, Newington Causeway ; R. G. Applegarth and A. E. Stove (engineers), 11, Queen Victoria Street ; E. G. Church, 120, Pollock Road, New Kent Road ; *J. S. Keay, 90, Ladbroke Grove. Directing qualification, 250 shares ; the company in general meeting will appoint remuneration. The signatories denoted by an asterisk are the first directors. Registered 8th inst by Shaen, Roscoe & Co., 8, Bedford Row.

**Electrical Accumulator Association, Limited.**—Capital £10,000, in £10 shares. Objects : To acquire and use any inventions, letters patent, &c., relating to or in connection with accumulating, storing, producing, supplying or using electricity or electrical currents or force ; and primarily to acquire the letters patent of the United Kingdom, No. 8,379 of 1886, granted to Anthony Reckenzaun for "Improvements in secondary batteries or electrical accumulators," or any share or interest therein. Signatories (with 1 share each), A. Reckenzaun (electrican), 7. Albert Terrace, Clapham ; John Stephens, 1, Cuba Street, Millwall (engineer) ; A. C. Adam, Hethersett Lodge, Putney ; J. R. Anderson, Stretton House, Putney ; Robt. Grant, Ferleigh, Westgate-on-Sea ; Alexander Smith, 1, Cuba Street, Millwall (engineer) ; G. Binswanger (electrician), 5, Great St. Thomas Apostle, E.C. Registered, without special articles of association, on the 10th inst. by Parker, Garrett and Parker, St. Michael's Alley, Cornhill. Registered office, 17, Gracechurch Street, T. A. Evans, secretary.

**Laurence, Paris and Scott, Limited.**—Capital £30,000, in £10 shares. Objects : To carry on the business of an electrical company in all branches, and for such purpose to adopt an agreement of 25th ult. for the purchase of the business carried on by Edward Alexander Paris and Wm. Harding Scott. Signatories (with 1 share each), *E. A. Paris, Gothic Works, King Street, Norwich (electrical engineer) ; A. J. Laurence, 13, Copthall Court, E.C. ; *W. H. Scott, Gothic Works, Norwich (electrical engineer) ; R. Haslewood, Carrow Works, Norwich ; T. W. Garrett Taylor, Norwich ; P. E. Laurence, 13, Copthall Court, E.C. ; Sydney Laurence, Clapham Park. Mr. Reginald Laurence and the signatories denoted by an asterisk are the first directors. Qualification, 100 shares. Remuneration, £250 per annum each, and in addition thereto, they may divide 25 per cent. of the net profits after 5 per cent. dividend has been paid. Registered 10th inst. by F. G. Monkland, 78, Gracechurch Street. Registered office, Gothic Works, Norwich.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Northern District Telephone Company, Limited.**—The annual return of this company made up to July 23rd was filed on July 31st. The nominal capital is £200,000 divided into 30,000 ordinary shares of £5 each (issued as fully paid) and 5,000 preference shares of £10 each, 4,997 preference shares have been taken up and the full amount has been paid thereon. Three preference shares and 778 ordinary shares are forfeited.

At the sixth annual ordinary general meeting of the company held on the 9th ult. at the head office, Arcade Chambers, Sunderland, the following resolution was passed as a special resolution, and was confirmed on the 26th ult. and duly filed on the 7th inst., viz :—That the articles of association be altered in manner following, that is to say :—

(*a*) The following article shall be substituted for

Article 67A., namely :—"They may borrow any sum or sums of money on such security and terms as to interest or otherwise as they may deem fit, and may secure the same by mortgage or other debentures, or by bonds or other securities, or by any mortgage or charge on or upon the whole of any property, funds, assets, or effects of the company or its uncalled capital ; but so that not more than £25,000 be owing at any time without the consent of a general meeting, and provided that no part of the said sum of £25,000 shall be borrowed without the consent of the United Telephone Company, Limited, and no borrowed money shall without like consent carry interest at a higher rate than 6 per cent. per annum.

(*b*) In Article 87 the word "and" coming after word "agencies" shall be omitted and the words "and trunk lines and new business" shall be inserted after the word branches. The clause as amended shall apply as from the formation of the company.

**Lineff Electric Traction and Light Syndicate, Limited.**—An agreement of 10th ult., filed on the 9th inst., between E. H. Bailey, of 42, Newington Causeway, of the first part, John Seymour Keay, of 90, Ladbroke Grove, of the second part, Alexander Login Lineff, of Buckingham Street, Strand, of the third part, and Robert Applegarth, of 11, Queen Victoria Street, of the fourth part, provides for the purchase by the company of the following letters patent, viz., No. 8,380, dated 10th June, 1887, granted to A. L. Lineff and Wm. Jones for "Operating tramcars by electricity ;" No. 13,447, dated 4th October, 1887, granted to A. L. Lineff and E. H. Bayley for "Electrical railways and tramways." The purchase consideration is 8,000 shares of £1 each.

**United River Plate Telephone Company, Limited.**—The annual return of this company, made up to the 26th ult., was filed on the 9th inst. The nominal capital is £500,000 in £5 shares. 50,000 shares have been issued, upon which the full amount has been called. 16,000 shares are considered as paid up, and upon the remaining shares £170,000 has been received in response to calls.

**Domestic Battery Syndicate, Limited.**—At an extraordinary meeting of this company, held on the 19th ult. at 9, Gracechurch Street, it was resolved to wind up voluntarily, and to appoint Mr. T. Anderson Hanson as liquidator. The resolutions were confirmed on the 3rd inst., and duly registered 9th inst.

**Kensington and Knightsbridge Electric Lighting Company, Limited.**—The statutory return of this company made up to the 3rd inst. was filed on the 9th inst. The nominal capital is £250,000 in £5 shares. 6,020 shares have been taken up, of which 5,000 are considered as fully paid up. Upon 400 shares £5 per share has been called, and £3 per share upon 620 shares. The calls paid amount to £3,060, and unpaid to £800. Registered office, Kensington Court Electric Lighting Station, High Street, Kensington.

**Schanschieff Electric Battery Syndicate, Limited.**—The registered office of this company is removed to 44, Basinghall Street.

## THE UNITED STATES PATENT OFFICE A SNARE AND A DELUSION.*

By W. C. BARNEY.

FOR the benefit of all whom it may concern, specially of inventors, who may intend to seek protection in the United States for their inventions from the Patent Laws of the United States, I caution them against indulging the hope that their application for patents will receive an intelligent examination or a fair judgment on the merits of their inventions.

I admit that the Patent Laws of the United States are all that can be asked for, but the administration of these laws is a disgrace to the Government and people of the United States and a delusion and a snare to inventors and patent attorneys.

One great evil is the constant changes in the practice of the Patent Office. It appears that every successive Commissioner of Patents attempts to make a record for himself as a wise lawyer and efficient administrator by changing the rules of practice from time to time, and especially by reversing the decisions of his predecessors in office.

I will now refer to recent decisions of the principal Examiner in Electricity, one Brown.

Rule 75 says : "When an application is rejected, because the alleged invention is held to be inoperative, affidavits on deposition traversing the objection may be received."

Under this rule an applicant for a telephone transmitter with the movable electrode attached to a tympan, and not in contact with the fixed electrode, filed affidavits from two well-known eminent scientific experts in electrical matters—namely, Prof. Van der Weyde and Morton—that they tested instruments made strictly after the description in the specifications and found that the circuit was open when the instrument was in its normal condition, and that words and sentences spoken into the mouthpiece were distinctly, clearly, and loudly reproduced by the receiver constructed as described by Bourseul in 1854—namely, an electro-magnet having a plate of iron so flexible that it will not miss any of the vibrations produced by the human voice.

Notwithstanding this indubitable evidence of the existence of a fact, this phenomenon of science, Brown, persisted in rejecting the application for a patent, because its mode of operation, the make-and-break, "conflicts with his opinion that articulate speech cannot be successfully transmitted in that theory."

This question came before the three Examiners-in-Chief on appeal, and this examiner, full of science and law, in his answer to the appeal disposed of these affidavits in the following words :—

"A number of affidavits have been filed with a view of showing that the opinion of certain persons is that the instrument described will transmit articulate speech. These affidavits are insufficient for the purpose intended, for the reasons that the opinion of the persons as to the general operativeness for telephonic purposes of the make-and-break instruments is opposed by all recognised judicial authority."

Fortunate indeed would be a person on trial for murder, which fact was proven by two witnesses, to have this distinguished jurist, Brown, for judge, who no doubt would set aside the sworn statement of the fact as mere opinions. So much for the intelligent action of this examiner, rendered famous, or rather notorious, by the record of his decisions published in your world-wide circulating REVIEW.

But this is not the end of the wise and learned judgments of the officials of the Patent Office. The worthy Board of Examiners-in-Chief on appeal supports this theory put forth by the Examiners-in-Chief, and announces its decision "that articulate speech cannot be transmitted by means of a make-and-break instrument," and thus relieves the scientists of the world from any further investigations of the theory of the telephone ; an appeal, however, lies from their decision, and therefore it is not necessarily final. Upon the Commissioner of Patents rests the final judgment as to what is the correct theory of the telephone. Scientists throughout the world will please take notice that the present Commissioner of Patents, J. Benton Hall, has settled that question, and decided that the make-and-break theory is wrong. It may be not amiss to state just here that all of these persons, learned in science and law, have pronounced their decisions without having made any tests of any instrument which operated strictly on the make-and-break principle, and so confirmed are they (in their profound ignorance) of the correctness of their theory, that they refuse to allow an applicant to present his instrument to be tested by them, because it operates on the make-and-break theory.

Washington, *July 15th*, 1888.

* This came to hand some time previous to the "American Notes" of "Das Telephon," which appear on another page.—EDS. ELEC. REV.

## A SWINGING ARM GALVANOMETER.*

By PROF. GEORGE S. MOLER, A.B., B.M.E., Cornell University.

THE objects sought in the construction of this galvanometer were applicability to a great range of currents, accuracy of indication and portability. In passing from the measurement of large to that of small currents no change in the apparatus is necessary, and still throughout a wide range great sensitiveness is maintained.

These ends are attained by making use of the fact that the influence of a current on the magnetic needle varies with change of distance and with the angle which the plane of the coil makes with the horizon. The principles of the sliding coil galvanometer and of Obach's cosine galvanometer are thus combined. A movable arm is hinged to the base of the galvanometer, fig. 1, and carries the coil, which is attached to its outer end. The length of the arm is such that in the vertical plane the needle will be in the axis of the coil. By means of screw clamps, the hinges are made to produce friction enough to hold the arm in any required position.

When the coil is brought up into the vertical plane it is very near the needle and a small current will produce a deflection. In this position, which is that of maximum sensitiveness (since the distance is a minimum and the angle which the coil makes with the horizontal plane is 90°) $\frac{1}{100}$th of an ampère produces a deflection of about 8 mm.

As the arm is carried down toward the horizontal position, greater and greater currents must be employed to produce the same effect. The position of the coil can be read upon a graduated quadrant which passes through it, there being a pointer attached to the coil and extending inward to the graduations.

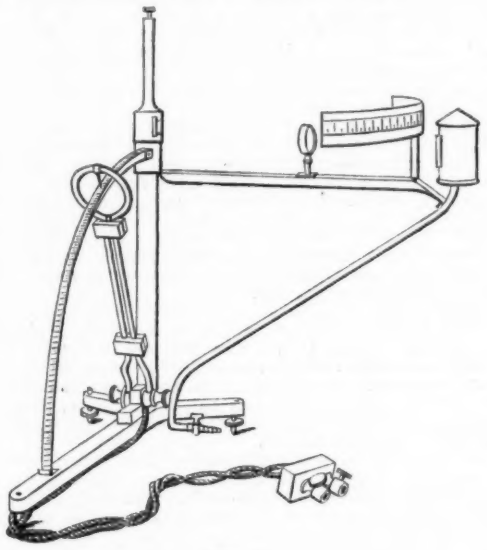


FIG. 1.

The arm consists of two parallel bars of copper, terminating in the two hinges. These are insulated from each other, and from them two flexible conductors are carried to the extremity of the base; after that they are twisted together for a distance of about 1 metre and end in a block to which two large binding posts are attached.

The coil is made of a copper rod 8·5 mm. thick, and its outside diameter is 76·5 mm. The radius of the graduated quadrant is 343 mm. and it is divided into twentieths of an inch. The radius of the lamp scale is 381 mm. The scale forms the arc of a circle, having the galvanometer mirror for a centre. Its length is 500 mm., and it is composed of paper rendered semi-transparent by being treated with castor oil.

The needle is shown in fig. 2. It is a bell-shaped magnet carrying a mirror, which can be rotated slightly upon the suspension rod for the sake of adjustment.

The needle is suspended by means of a fine silk fibre and is prevented from making a complete revolution by means of a stop. Its motions are damped in the usual manner by the action of a surrounding cylinder of copper.

The rays of light from a small gas lamp, shown in fig. 1, after passing through a lens, are reflected from the mirror and then fall upon the scale. When the plane of the swinging coil is in the magnetic meridian and no current is flowing, the spot of light will fall at the centre of the scale. The lamp and scale are attached rigidly to the body of the instrument for the sake of rigidity and to avoid the necessity of repeated calibrations. In the lamp case is a small circular opening having a fine vertical cross-hair of platinum, and the lens is so placed that the image of the cross-hair is sharply defined upon the scale. All parts of the scale being equally distant from the mirror, as shown in fig. 1, the definition of this image is equally good for all deflections.

* Read before the American Institute Electrical Engineers, by Prof. E. L. Nichols, May 16th.

The swinging-arm galvanometer is especially designed to be used with the method of constant deflections. By carrying the coil up from the horizontal position, the spot of light will be deflected more and more, until the image of the cross hair is made to coincide with the chosen mark upon the scale; the position of the coil is then to be read and the current found by reference to a calibration curve or chart. In the measurement of feeble currents, the chosen point on the lamp scale may be near the position of no deflection, while for stronger currents it may be further away. Several deflection points may be thus chosen and a calibration by means of some standard instrument can be made for each; then, to insure greater accuracy in the determination of a current, several of these points may be used, and the mean of the currents indicated by them may be taken, giving to each its proper weight.

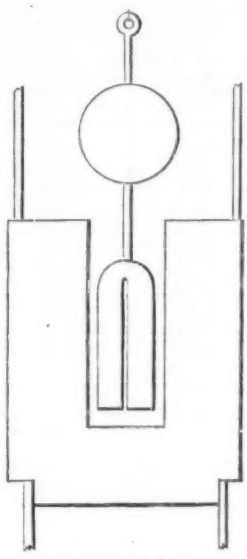


FIG. 2.

The instrument may also be used by taking different fixed positions for the coil and reading the deflections of the spot of light, calibrating for each of these positions as before. These two methods may also be combined by moving the coil until the spot of light is approximately in coincidence with a selected deflection point, observing its distance from the same and applying to the current value, by means of the previously determined figure of merit, the proper correction. In this way changes in a slightly fluctuating current can be followed and measured by moving the coil.

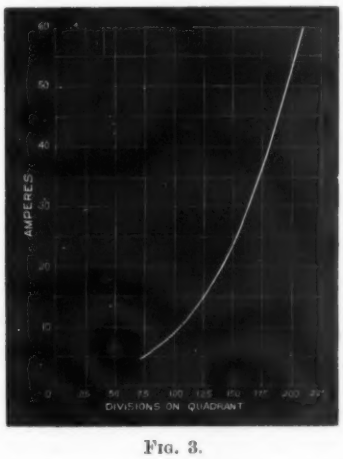



FIG. 3.

In order to indicate heavy currents to an audience in a lecture room it is only necessary to remove the lamp stand and scale and to make use of the stronger light of the magic lantern, the image of a slit in the field of the lantern, after reflection from the galvanometer mirror, being thrown upon a wall or screen. A position of the coil can then instantly be found which will produce suitable deflections for any given current, from a fraction of one ampère up to that which the coil and connections can be made to convey without destruction from heating.

In the curve, fig. 3, and the accompanying table are given the results of a calibration of a galvanometer of the pattern just described, which has just been constructed in the Department of Physics in Cornell University.

The deflection selected was 10 cm., and the measurements,

which extended from 3 ampères to 60 ampères, by no means covered the possible range of the instrument. The movement of the coil, indeed, covered only 200 of the 400 scale divisions into which the reading quadrant is divided.

The calibrations were made in the magnetic observatory of the University, in which locality the average value of the earth's horizontal intensity is ·1713. The currents were measured upon the great tangent galvanometer.

Simultaneous readings were made upon that instrument and upon the swinging-arm galvanometer.

The readings of the great galvanometer, reduced to ampères, with the corresponding positions of the swinging coil for a deflection of 10 cm., are given in the following table :—

CALIBRATION OF THE SWINGING-ARM GALVANOMETER BETWEEN 5 AMPERES AND 60 AMPERES CONSTANT DEFLECTION = 10 CM.

| Current in ampères (large galvanometer). | Quadrant readings (swinging-arm galvanometer). | Current in ampères (large galvanometer). | Quadrant readings (swinging-arm galvanometer). |
|---|---|---|---|
| 5·21 | 79·0 | 19·48 | 138·0 |
| 5·54 | 79·5 | 24·42 | 151·0 |
| 5·84 | 82·0 | 24·48 | 151·5 |
| 8·04 | 95·8 | 32·00 | 167·0 |
| 10·35 | 106·0 | 33·44 | 168·5 |
| 10·39 | 107·0 | 33·99 | 171·0 |
| 10·86 | 110·0 | 38·50 | 179·5 |
| 11·53 | 110·0 | 42·79 | 185·0 |
| 13·25 | 119·0 | 43·90 | 187·0 |
| 13·92 | 119·5 | 46·14 | 191·0 |
| 15·25 | 125·0 | 53·56 | 202·0 |
| 19·39 | 137·5 | 59·39 | 208·0 |

From these values, with the readings of the new galvanometer as abscissæ and currents in ampères as ordinates, the curve shown in fig. 3 has been constructed.

From this curve the currents for intermediate positions of the coil may be determined and the degree of accuracy of which the instrument is capable may be estimated.

## AMERICAN NOTES.

By DAS TELEPHON.

THE Bell telephone patents received a very severe shock from the decision rendered in the U.S. District Court at Chicago, Illinois, in the suit brought by the Bell Telephone Company against the Cushman Telephone Company, although the Bell Company gained their suit, and the Court decided that the Cushman instruments were infringments of Bell's patents.

Dr. Cushman's claim was that, in 1851, while experimenting with a lightning tester, he accidentally discovered the principle of transmitting articulate speech by an electric current, and constructed an apparatus which was used as a telephone. The Court had to pass on a question of fact, and Judge Blodgett, in his finding, says :—

"My conclusion is that Dr. Cushman, with the aid of W. P. Cushman and B. T. Blodgett, in Racine, during the summer of 1851, did make a device containing magnetic coils through which spoken words could be and were transmitted at short distances, that the transmission was faint and the words difficult to hear, and the attempt to talk through them was often a total failure, and occasionally, when all conditions were favourable, only a partial or meagre success was obtained. . . . . I have no doubt from the proof that the machines made by Dr. Cushman, W. P. Cushman, and B. T. Blodgett in 1851 were in all practical respects as good as any that were made afterward by Dr. Cushman or those who assisted him."

The importance of this decision in the United States is apparent on referring to the decision of the Supreme Court of the United States on 19th March, 1887. In that decision the Chief Justice said that Bell had discovered that articulate speech could be transmitted by means of an undulatory current of electricity, and that his claim to the use of that kind of current for that purpose was valid. That Bell was the first person who had succeeded in transmitting articulate speech, and also "that it seemed that articulate speech could not be transmitted by any other means."

In the trial at Chicago the decision was that "Cushman had made a device in 1851, through which spoken words could be and were transmitted." It is, therefore, an established judicial fact that Bell was not the first to transmit articulate speech by means of electricity. His first success was on 10th April, 1876, just thirty-six days after his first patent was issued, and upon which depends his famous claim.

Now that a court has decided that Cushman invented an instrument by which articulate speech was transmitted by means of electricity in 1851, *twenty-five years* before Bell accidentally discovered that his device for multiple telegraph, patented 7th March, 1876, would transmit articulate speech, there is no doubt that Prof. Bell, who is "an honourable man,"—"so are they (the Bell Company) all honourable men"—will hasten to acknowledge that to Dr. Cushman belongs the honour of the discovery, and that he will ask permission of the French Academy of Sciences to hand over to Dr. Cushman the 300,000 francs which they awarded to Prof. Bell for his (supposed) discovery.

In the REVIEW there has been from time to time lists of claimants to be first inventors of the telephone, and up to this time Charles Bourseul, a French soldier, has been universally acknowledged to have been the first to describe in a printed book a magneto-telephone, published August 26th, 1854. But the fact has now been established by evidence in a U. S. District Court, and been decided by that court, that Dr. Cushman is the first to devise an instrument by which articulate speech has been and can be transmitted.

I have sent to Chicago to obtain copies of the briefs and pleadings in this important case, and shall send full particulars, so that your intelligent readers may render homage to whom homage is due.

It may seem paradoxical that the Court should hold that Cushman had a magneto-telephone in 1851, and also decide that Cushman's instruments were infringments of Bell's patent; but there is nothing incompatible with the correctness of the two statements by the judge. Cushman invented a magneto-telephone in 1851, but he did not apply for a patent for it, nor did he publish a description of it, nor did he introduce it to the public, and Bell was the first to obtain a patent for the magneto-telephone, and Cushman, by his neglect to do either of the above stated three things, lost his right to use his own invention. This case is to be appealed to the Supreme Courts, and what effect it may have then on the Bell patent is a matter of conjecture merely. In my opinion if Dr. Cushman can establish the fact that he had exhibited his device to any one person, that would be held by the Court to have been an introduction to public use, and Bell's claim would be judicially vacated, as it is morally. No doubt this Cushman case, or rather the facts established by it, will be before the Court on the trial of the case of U. S. *v.* the Bell Patent.

Mr. Brown, the examiner of electrical applications in the Patent Office, has added greater length to his ears by several recent decisions. I have ordered copies of the official papers, and shall send them to the REVIEW, so that inventors and patent attorneys may know the extent of the powers he assumes to limit by his *opinion* the functions of a device.

In these "Notes" the attention of inventors has frequently been called to the practices of the U.S. Patent Office, and to the various devices devised by the Commissioner of Patents from time to time to delay, hinder, and annoy applicants for patents, and instances of the assumption of legal knowledge by Examiner Brown, of the electrical division, have been given; but this examiner has lately issued a document which surpasses all his former efforts to immortal fame.

I send copies of documents on file in the Patent Office, by which your numerous readers will learn that Examiner Brown, in the depth of his scientific attainments, has definitively settled the mooted question of the theory of the telephone, and, at the same time, annulled a decision of the Supreme Court of the United States. In order to fully appreciate the importance of this latter decision by Brown, now immortalised in your REVIEW, your readers should know that a decision of the Supreme Court of the United States is the supreme law of the United States, and overrides any Act of Congress, or of the President or any officer of the Government. Yet this examiner, as will be learned from his letter given below, annuls the decision of the Supreme Court "that a patent for an invention covers all the uses to which it can be put."

In order that your readers may fully understand the decision of the examiner the facts antecedent should be known, which are as follows, as per record from the Patent Office :—

On February 7th, 1887, W. C. Barney filed an application for a patent for "pneumatic intermittent circuit closer," to be used for the reproduction of musical, vocal, articulate, simple and compound sounds." Mr. Examiner Brown rejected this application on the ground that the reproduction of speech by intermittent currents was against his theory. Affidavits of eminent electrical scientific professors, and of well-known practical telegraphists and telephonists, that the instrument did reproduce articulate speech, were filed as authorised by the rules of the Patent Office; but this examiner, and also the Commissioner of Patents, J. Benton Hall, refused to accept as evidence those affidavits of *facts*, and called the affidavits *opinions*. The applicant made a formal petition to the Commissioner to instruct the Examiner to test the instrument; but the Commissioner refused to do so. His extraordinary decision was published in the REVIEW. The application was finally rejected *without a trial* of the instrument, on the ground that its operation was against the *theory* held by the Examiner and by the Commissioner.

The applicant then erased the words "musical, vocal, articulate, simple, and compound," and substituted the phrase "vocal and other sounds."

The Examiner then held that "*vocal*" was the same as "*articulate*," and rejected the application. An appeal was taken to the Board of Appeal, consisting of three Examiners-in-Chief, and they recommended the words "vocal and other" to be eliminated. Under this pressure the applicant eliminated those words and

requested that a patent should be issued, protesting in very strong language against the decisions of the patent officials.

Mr. Examiner Brown thereafter had the cool assurance to send to the applicant the following letter, which it is clear was totally uncalled for—in fact, irregular and impertinent:—

"U.S. Patent Office, July 23rd, 1888.

"To W. C. Barney.

"The Examiner denied, and now denies, that the instrument exhibited in the specification and drawing of your application is a telephone or can transmit speech by the make and break principle, and the Examiners in Chief on appeal affirmed this position, and to that end required applicant to limit his specification and claim by striking out all reference to transmitting speech or vocal sounds. The office neither could nor desired to go further than this, inasmuch as, excepting these particular sounds, the instrument is capable of transmitting sounds generally—such, for instance, as musical and other sounds depending upon the rate of vibration.

"In view of this record, the application is this day passed to issue, but it is deemed proper to call applicant's attention to the construction expressly put upon the application and the limitation imposed, for fear that he, as his argument seems to imply, intends to give a wider interpretation. Applicant is advised, therefore, if he still insists upon his theory, that this application, as now limited, does not cover it as applied to the transmission of speech, and that he had better not patent such application if he designs it for the protection of such an invention."

The applicant, in reply to the above letter from Examiner Brown, wrote the following letter to the Commissioner:—

"The Hon. Commissioner of Patents.

"Sir,—I have received from Examiner Brown a letter dated July 23rd, 1888, containing statements of a most extraordinary character, which will be a disgrace to the administration of the Patent Office if that letter be allowed by you to remain in the files of your office.

"It is evident that the Examiner's duty was simply to inform me that the application was allowed. I hereby enter my protest against that letter being placed in the file record of my application, No. 226,851. Not because I apprehend that the statements of the Examiner can have any effect, even the most remote, upon my invention, its uses or the patent for it; inasmuch as the *decision* of the Examiner, that my instrument will not transmit articulate speech, cannot prevent it from transmitting articulate speech, if that is one of its functions.

"I have heretofore, on several occasions, called the attention of the Examiners to the indisputable fact that neither his opinion nor that of all the officials of the Patent Office can endow an instrument with functions it does not possess, nor deprive it of functions it does possess.

"As I know well that my instrument, acting on the make and break principle, will transmit 'musical, vocal, articulate, simple, and compound sounds,' I desire to obtain a patent for the protection of my invention for all the uses to which it can be applied, notwithstanding the statement by the Examiner 'that this application as now limited does not cover it as applied to the transmission of speech.'

"'The construction put upon the application, and the limitations (attempted to be) imposed upon it' by the Examiner, cannot in any manner have any effect to deprive my instrument of any function it does possess.

"Canute, of old, said to the ocean, 'Thus far shalt thou go, but no farther;' and now an Examiner in the U.S. Patent Office says, '*This instrument is permitted to transmit musical and other sounds, but I forbid it to transmit speech.*'

"This application cannt be limited by the opinions of any or all the officials of the Patent Office.

"Having entire confidence in the decision of the Supreme Court of the United States delivered by Chief Justice Waite in the following words, 'A patent for an invention covers all the uses to which it can be applied, whether the inventor knew them or not,' I request that a patent for the invention may be issued without delay.

"I request the Commissioner to inform me what action he will take in regard to the letter of 23rd July, 1888, of Examiner Brown, so that I may determine what action I shall take.—Respectfully,

"W. C. BARNEY."

The perusal of these papers, it is hoped, will be of service to inventors who may wish to seek protection in the United States for their inventions, especially those concerning electricity.

The conclusions to be drawn from the above recital of the action of the U.S. Patent Office are, that an applicant for a telephone transmitter should carefully avoid any allusion in his specification or claims to the transmission of speech, even if his instrument be the most perfect of its kind for that purpose, but to claim the transmission of "sounds" generally, as it is evident that a patent with such a claim would cover all species of sound; and likewise if the application be for a telephone receiver, he should claim the reproduction of "sounds," avoiding all reference to speech. The record in this case of Barney's shows that a patent has been allowed for his instrument for reproducing "sounds." The instrument has been working in an office in Washington for the past six months, and I have very often tested it, and can truthfully say that it operates on the make and break principle, and that the articulation is remarkably distinct.

As the patent will probably be issued shortly I shall not now speak further about it, and shall send you a copy in due course.

# CITY NOTES, REPORTS, MEETINGS, &c.

## The "Pilsen," "Joel" and General Electric Light Company, Limited.

AN extraordinary general meeting of the shareholders of this company was held at the Cannon Street Hotel on Friday, the 10th inst., Sir Rawson W. Rawson, K.C.B., the chairman, presiding. A circular had previously been sent to the shareholders, signed by the chairman and the other two directors and two members of the committee appointed at the last meeting of the company, held on June 27th, in which it was stated that no tenders had been received for the patents, plant, stock and goodwill of the company's business in response to advertisements which had been issued in several papers. Mr. Gwynne, a member of the committee, however, had made an offer for the purchase of the entire undertaking of the company, taking over all assets and liabilities as they stood on July 26th, for £4,550. Mr. Gwynne's intention, according to the circular, was to provide forthwith considerable further capital (£10,000 or more), and then to continue the business by the formation of a new company, with a small body of shareholders. He was prepared, should his proposal be favourably entertained, to at once buy any partly paid shares at 4s. per share, and any fully paid shares at 18s. per share, and would afford holders of not less than 100 shares an opportunity of joining him in his new company. The alternatives, other than the sale to Mr. Gwynne, appeared to be that the remainder of the company's capital would be called up for the extension and development of the business on the company's own account, or that voluntary liquidation should be entered upon for realisation of the assets and distribution thereof amongst the shareholders, after satisfying the liabilities. In this latter alternative the risk of the uncalled capital being called up in the liquidation, though eventually returned, was to be borne in mind. The opinion of the directors was that the proposal of Mr. Gwynne should be accepted, as no better course presented itself. Of the members of the committee, Mr. Fyfe dissented, Mr. D. Parrish was absent from England, and Mr. Phillips was in agreement with the directors; the fourth member of the committee was Mr. Gwynne himself.

The notice convening the meeting having been read,

The Chairman said: I have no doubt you have all received the circular which explains the circumstances under which we meet to-day and the view that the directors take of our present position, and of the only offer that has been made to us, that of Mr. Gwynne. At the last meeting a committee was appointed and instructed to consider the best means of disposing of the property of the company, and as an alternative to consider the advisability of continuing the business. Accordingly the directors have met those members of the committee, and the result is communicated in the circular. We issued advertisements for tenders in accordance with the desire of the shareholders, and the result has been that there has not been a single offer and only four applications to become acquainted with the nature and value of our business. Under these circumstances, Mr. Gwynne, a member of the committee, whose attention, it appears, has been called to this matter for some considerable time, has made an offer, and this the directors now submit to the shareholders for their consideration with their recommendation that it should be accepted upon the ground that it makes an offer to those who do not desire to invest any more money in this company, and at the same time offers to those shareholders who have confidence in the future of electric lighting and who are prepared to pay the balance of calls, amounting to 12s. per share, an opportunity of joining Mr. Gwynne in the future management of the business, sharing equally with him in the advantages and profits, whatever they may prove to be. I wish to say that I am aware that a circular has been issued to the shareholders by Mr. Fyfe since the appearance of this circular; he has not thought it necessary to send me or my co-directors a copy of it, but I am perfectly aware of its existence, and there is one point in it which contains an error which I desire to correct. It states that the balance of assets which Mr. Gwynne will obtain possession of when this contract is carried out amounts to £1,500. I wish to say that that is entirely an error; it does not amount to a third of that sum. That is a mistake, and on the whole the directors are of opinion that inasmuch as this offer gives nearly as much as the market value of the shares at the present moment, as it imposes upon Mr. Gwynne all the responsibility of finding the capital for carrying on and extending the work, which it is admitted by all parties is absolutely necessary, and inasmuch as Mr. Gwynne encourages all those to join him who hold such an interest in the company that he can secure their acting with him for the benefit of the company and for no other purpose, we consider that it is an offer which it is to the interest of the shareholders to accept. There are but two alternatives. We presume that the shareholders are not prepared to adopt one of them. The alternatives are, first, to carry on the business, calling up the 12s. a share remaining due, or to dispose of the business. The shareholders at previous meetings have declared their opposition to paying further calls. The directors have endeavoured to obtain an offer for the business, and to dispose of it on the best terms that they can, and it will rest with you to-day to decide whether this offer shall be accepted or declined. There is one thing which I must point out, that under any circumstances, whether Mr. Gwynne's offer or anybody else's offer be accepted, the only way of carrying out the object which we all have in view is by voluntary liquidation, by means of which the company, when reconstituted, will

start clear, with only a liability for the capital invested in it, and will get rid of that which has been the difficulty of the directors and will be the difficulty of the company if carried on by paying up the further calls, namely, the nominal value of the patents and goodwill, which stand at £25,000. Until that is arranged in some way you cannot divide profits. I do not think I have anything more to say. I wish to avoid all points likely to lead to unnecessary discussion, or recrimination, and therefore I put the question before you as a mere matter of business to accept this offer or not to accept it. I propose this resolution:—"That the undertaking of the company be sold to Mr. Gwynne, he taking over all assets and liabilities as they stood on July 26th, 1888, at the price of £4,550, and upon such other terms as may be arranged between the directors or the liquidators of the company and Mr. Gwynne." That latter clause has reference to the arrangement which Mr. Gwynne has proposed, and by which he is prepared to abide, but which our lawyers have found very difficult to put into black and white.

Mr. Whately seconded the resolution, explaining in more detail than the chairman had done the terms of the offer made by Mr. Gwynne and the conditions upon which he was willing to admit other large shareholders to participation in the future conduct of the business. He remarked that there were suggestions that if they waited a little while they would get a better offer, but he could only say that this question of the sale of the company's plant and business had been before the world a very long time, and they had received absolutely no offer at all but that of Mr. Gwynne. With regard to the absence of Mr. Parrish's signature to the circular, that gentleman was aware of the offer, and had sent in his proxies to vote for it. Mr. Gwynne, he might say, did not confine his offer of participation to those who already held 100 shares; anyone having less than 100 shares who liked to buy more to make up that number would be equally welcome.

A Shareholder inquired what was the balance at the bank on July 26th.

Mr. Whately said he had had a statement of the assets and liabilities worked out for that meeting, and the balance at the bank, after allowing for moneys owing to the company (which might not be realised to the full amount) and moneys which the company would have to pay, was £450 7s. 8d.

Mr. G. H. Sprules said he thought before the company was sold to one of the directors it ought to be known how much had been subscribed in cash to keep it going up to that time, and what the present income was.

The Chairman explained that Mr. Gwynne was not a director, had never been one, and had never been associated with the directors, but was named by the shareholders at the last meeting as one of their representatives to look into the affairs of the concern. Mr. Gwynne was a perfect stranger to him (the chairman) and to his colleagues, and they recommended acceptance of his offer simply because they believed it to be the best they were likely to get.

Mr. Ross repeated the first question of Mr. Sprules, as to how much money the directors had received from the shareholders since the company started, and further asked what the assets consisted of, how long the company could go on without a further call being made, and what any further call was needed for in the event of the company going on.

The Chairman, answering the last questions first, remarked that the directors had said from the beginning that to carry on the business with any prospect of advantage, they must call up further capital. That had been acknowledged to be necessary by every gentleman who had looked into the affairs of the company. The present directors were not prepared to carry on the business, with the extension which would become necessary, by themselves; they were not engineers, they had no one on the board qualified to assist them in judging of technical matters, and they were conscious that without a considerable outlay for developing the business it would not be worth while carrying it on. They had been, in pursuance of their instructions, simply keeping the company alive until the moment for extension might arrive. That moment had arrived: electric lighting legislation had undergone improvement, and there was now an anxious desire on the part of the public to get the electric light. Large companies were being started in different parts of London, and with these they would have in some degree to compete. Their plant was now four or five years old, many new discoveries and inventions had been made in electricity and many new applications for economy had been introduced, and they would be expected to employ these if they continued their business. They could not do that without an increase of capital. The assets were, plant at the Bethnal Green Museum, plant at Holborn, and plant at Stanhope Street. These were good for their current business, but they were upon annual rentals which might cease at the end of a year.

Mr. Whately said they might see from the last balance sheet that the subscribed capital was £38,000. Several sums had been written off in past years before he joined the board, and he could not, off-hand, say what the total amount of the capital from the beginning was. The rentals amounted to £5,000 a year, but they had the expense of maintenance, which left them no profit at all. They were working without a loss, but that was all. One patent, the Pilsen, which had six years to run, was the only one they had to sell, and that was included in the assets. It must be recollected that they had lighting contracts running, and these were a serious liability to the company.

A discussion of a recriminatory character here occupied considerable time, but it was mainly of personal interest only.

Mr. Pollock, who stated that he held a power of attorney to act for Mr. D. Parrish, said he should in that gentleman's name withdraw the proxies which the directors said they held from him. He proposed that the further discussion of Mr. Gwynne's proposal should be adjourned for a certain definite period in order to see if some better offer might not be received. He had reasonable expectation that a better offer would be made.

Mr. Gwynne, who complained of the unfair way in which he had been treated and attacked by Mr. Fyfe, declined to keep his offer open. It must be either accepted or rejected at that meeting. As the result of a desultory discussion, he said he was prepared to increase his offer to £6,000, provided the condition as to other large shareholders having the option of joining him were omitted. He concluded his remarks by saying that at the last meeting he was one of the men who led an attack upon the directors. In consequence of the statements made to him by Mr. Fyfe, he entered into the enquiry thoroughly saturated with prejudice against the directors, believing them to be the essence of all that was bad. He had now gone thoroughly into the matter, had been to the works dozens upon dozens of times, and he was bound as an Englishman and a gentleman to confess that he had been deceived. Instead of finding a gang of men doing all they possibly could to rob the shareholders, he found a body of gentlemen who were prepared to do the best they possibly could for the interests of the shareholders. He had not the pleasure of a personal acquaintance with the chairman, but by his courteous, honourable, and straightforward conduct he had not only removed the prejudice he had previously felt against him, but had brought him to feel that he should be delighted to be associated with Sir Rawson Rawson in any business with which he was connected. He placed implicit confidence in him, in the other directors, and in the officers of the company. He could only openly apologise for the gross misstatements he had made respecting them.

Mr. F. L. Rawson said that on behalf of Woodhouse and Rawson, Limited, he had looked into the business and had made the Pilsen Company an offer, which, however, was not accepted. He considered that Mr. Gwynne's offer ought to be accepted, as it gave those possessing over 100 shares a right to become part purchasers of the business upon the same terms as Mr. Gwynne himself. The only point in which he would suggest amendment of the terms was that Mr. Gwynne should extend his offer to the smaller shareholders, retaining a right to exclude any shareholder who he believed would do harm to the business. With regard to the difficulties which Mr. Fyfe had caused, he had known Mr. Fyfe for a long time, and believed that he meant to be straightforward in his dealings with the directors. It must be recollected that three or four years the shareholders had instructed the directors to carry on the business as far as they could without loss until the position of electrical matters changed for the better. This he considered they had done in a thoroughly satisfactory manner, and it was not right to blame them for the position the company was in.

Mr. Gwynne said that any shareholder who was willing to qualify to the extent of 100 shares could do so and join him upon an equal basis, but he was not prepared to go further.

Mr. Fyfe, replying to some remarks at an earlier stage by Mr. Gwynne, said that he had never intended that that gentleman should get the business for less than it was worth, and he thought it was worth more than was now offered for it.

Mr. Roper said he preferred the offer of £6,000 made by Mr. Gwynne, and he moved as an amendment that that offer should be accepted, with the view of testing the views of the meeting. He had implicit confidence in the board. He believed that, badly as the affair had turned out, they were in no way in fault.

Mr. Layton seconded the amendment.

Mr. F. L. Rawson thought if the shareholders accepted that offer they would make a great mistake. In his opinion, with good management, such as he believed that company would have and had had, considerably more might be made of it.

Mr. Griffin said he came there prepared to oppose Mr. Gwynne's offer, after receiving a circular from Mr. Fyfe, but after hearing Mr. Gwynne's explanation he had quite changed his opinions, and was disposed to join him.

After further conversation, Mr. Roper withdrew his amendment, and the original motion was put to the meeting, with the result that 13 voted for it and 12 against. A poll was demanded and taken, the voting being 6,352 for and 1,424 against. The resolution was therefore carried.

Mr. Gwynne said the shareholders had behaved badly in robbing the directors of their fees, but it was his intention that they should be paid.

The Chairman moved that the company be wound up voluntarily.

Mr. Whately seconded, and the motion was carried, as was a further resolution appointing Mr. W. H. Trentham, the secretary, liquidator of the company.

A vote of thanks to the chairman terminated the proceedings.

**Western Counties and South Wales Telephone Company, Limited.**—The warrants for the interim preference dividend for the half-year to 30th June, at the rate of 6 per cent. per annum, were posted on the 9th inst.

## TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending August 10th, 1888, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £4,141.

## NEW PATENTS—1888.

11274. "Improvements in galvanic belts or chains." J. B. THISTLETON. Dated August 3.

11312. "Certain improvements in scoring boards used by billiard players and others, and in means for operating the indicating devices by electricity." J. HAMER. Dated August 4.

11328. "Improvements in obtaining electricity for electric lighting motive power and other like purposes." W. BOGGETT. Dated August 4.

11338. "Improvements in telephone line circuits." L. KELNER. Dated August 4. (*Complete.*)

11352. "An improved electric pen or pen and holder, specially applicable for stippling and similar purposes." J. SCHOLEFIELD. Dated August 7.

11376. "Improvements in syphon recorder telegraph instruments." G. DRAPER and W. H. ASH. Dated August 7.

11377. "Improvements in syphon recorder telegraph instruments." G. DRAPER and W. TUCK. Dated August 7.

11388. "A system of, and means or apparatus for, automatically and electrically indicating the breaking of a train, or for actuating signals on railways." J. L. E. DANIEL. Dated August 7.

11403. "Improvements in apparatus for the propulsion of vehicles by electricity." H. H. LAKE. (Communicated by F. J. Weis, United States.) Dated August 7. (*Complete.*)

11411. "Improvements in armatures for dynamo-electric machines." A. W. MESTON. Dated August 7. (*Complete.*)

11441. "A combined shade and globe or chimney for oil lamps, chandeliers, gaseliers, electric lamps and the like." H. A. GALLIERS and F. KLAERR. Dated August 8.

11475. "An improved electrical stop-motion for automatically arresting the operations of apparatus for folding envelopes and similar articles of paper." C. BLANKE. Dated August 9.

11479. "Improvements in the manufacture of iodine and iodoform by electrolysis." T. PARKER and A. E. ROBINSON. Dated August 9.

11490. "Improvements in lock switches for electric circuits." A. C. COCKBURN. Dated August 9.

11491. "Improvements in the insulation of electric conductors and for the preparation of wires to prevent vibratory sound when used for telephonic and other electrical purposes." D. NICOLL. Dated August 9.

11495. "Improvements in the arrangement and construction of telephonic exchange systems." J. J. MANN and J. CUTLAN. Dated August 9.

11503. "Improvements in electric generators." L. S. M. PYKE and H. T. BARNETT. Dated August 9.

11511. "An improved system of automatic electric signalling for railways, and means or apparatus for use therewith." J. L. E. DANIEL. Dated August 9.

11514. "Electrically controlled apparatus for checking, extinguishing, and preventing the spread of fire, and for simultaneously giving the alarm." T. R. DOUSE. Dated August 9.

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1886.

7596. "An improvement in the construction of elements for secondary batteries or accumulators." J. PITKIN. Dated June 5. 8d. Claims:—1. A supporting plate of lead for the active material of an element of a secondary battery, having projecting studs which are cast upon its surface and burred over, or enlarged at their outer ends, as and for the purpose specified. 2. A supporting plate of lead for the active material of an element of a secondary battery, having studs which are cast upon its surface and burred over or enlarged at their outer ends, and having also flanges which are bent inwards or undercut, as and for the purpose specified. 3. An element for a secondary battery, consisting of a supporting plate of lead having projecting studs cast upon its surfaces and flanges around its edges, the studs being burred over or enlarged at the outer ends and the flanges being bent inwards or undercut, and of active material filling the cavities of the plate and covering over the studs, substantially as specified.

7704. "Fuse for dynamo-electric machines." E. J. HOUGHTON. Dated June 8. 6d. Claim:—The use in combination with the commutator brushes of dynamo-electrical machines, of a fuse of easily melted metal forming part of the shunt or main circuit of the machine and arranged in close contiguity to the brush where it is in contact with the commutator, so that when excessive sparking or flame occurs the fuse will be melted and the circuit broken, substantially as described.

7736. "Improvements in induction telephone repeaters." S. F. SHELBOURNE. Dated June 9. 8d. Claims:—1. The combination of two or more separate magnetic cores and their surrounding coils in parallel circuits of two insulated wires wound as one, said parts being in such relation that the opposite polarities of the cores of each pair shall be at their adjacent ends, as described in the specification. 2. Two parallel circuits of substantially equal length and resistance in identical correlation with each other about two or more independent magnetic cores, forming induction giving and receiving circuits (each to or from the other), as described. 3. Two or more soft iron wire bundles or cores, each within its separate coil of magnet wire, arranged in pairs, each pair having the opposite polarities of its members adjacent at the ends in combination with soft iron plates or heads extending across the poles of such pair, as and for the purpose set forth. 4. Two spools formed each with a magnet core and each wound with two insulated wires of substantially equal length and resistance, and in parallel circuit with each other upon both spools, being wound thereon in such a manner that the contained magnetic cores shall have opposite polarities at their adjacent ends, in combination with soft iron polar plates or heads, and an enclosing case or box of magnetic material, substantially as shown and described.

7749. "Improvements in telephonic switching apparatus." A. R. BENNETT and C. G. WRIGHT. Dated June 9. 8d. In telephonic switching systems which comprise the use of indicators reserved for the purpose of enabling subscribers to signal to the switching operator the termination of a communication, such indicators being commonly known as "ring-off indicators" or "ring-off drops," the inventors connect a branch from the coils of each indicator to its shutter or drop, and provide a contact, upon which the drop or shutter rests when it falls, which contact is in communication, either directly or through a switch or key with the operator's speaking instrument. Claims:—1. The improvements in telephonic switching apparatus, substantially as described. 2. In telephonic switching apparatus the employment in conjunction with each indicator or drop of a contact piece and connections, substantially as described, to provide for direct communication between each subscriber and the exchange operator's telephone upon the falling of the subscriber's indicator or drop.

## 1887.

8795. "Improvements in galvanometers with suspended coils." W. E. AYRTON and J. PERRY. Dated June 18. 6d. Claim:—In galvanometers with suspended coils the attachment of one or more small magnets to the coil for the purpose of preventing the sensibility of the galvanometer being altered by either a temporary or a permanent variation of the strength of the magnetic field, or of any part of the magnetic field in which the coil is placed.

10177. "Improvements in the manufacture or treatment of porous pots, plates, or partitions for electric batteries." E. L. MAYER and H. LIEPMANN. Dated July 20. 6d. Claims:—1. The improvement in the manufacture or treatment of porous pots, plates, or partitions for electric batteries, consisting in impregnating them with a suitable compound or chemical reagent and causing this to act upon or be acted upon by another suitable compound or chemical reagent, so that a body which shall not itself enter into any chemical action with the electrodes or electrolytes (or otherwise undergo any deleterious change) detrimental to the action of the battery may be separated and precipitated or deposited in the pores or interstices of the said porous pots, plates, or partitions. 2. The improvement in the manufacture or treatment of porous pots, plates, or partitions for electric batteries, consisting in the impregnation of the same with a substance containing the body or element to be deposited, and afterwards subjecting them to the action of heat so as to bring about the necessary decomposition of the said substance for the purpose of precipitating or depositing the said body in the pores and interstices of the said porous pots, plates, or partitions.

10740. "Improvements in regulators for electric lamps." S. MATHIS. Dated August 4. 8d. Comprises a bell crank lever turning upon a fixed point of the lamp; in holes at the end of the vertical arms of this bell crank lever is articulated a horizontal clamp lever, the clamp of which has an upper and lower shoe, which can alternately embrace the carbon holder placed at the centre of the mechanism. The horizontal extremity of the bell crank lever is loaded with a counterweight, but instead of the latter it may be acted upon by a spring or an electromagnet. A third lever constituting a double rocking lever turns at fixed points of the lamp, which are situated at such a height relatively to the pivot for the bell crank lever that the clamp lever shall be between the two arms of the double rocking lever. The latter is provided on its left-hand arms with an armature and an adjusting screw, and on its right-hand arms with a stop which, by the action of an antagonistic spring, bears against a collar fixed at a suitable height upon a rod of the lamp. An arm extending from this collar is traversed by a screw which establishes contact with a flat spring, thereby closing the circuit of a derivation which passes to an electromagnet arranged at a proper distance above the armature on the left-hand arms of the rocking lever. There are 2 claims.

11004. "Improvements in apparatus for the electrical propulsion of tramcars and other vehicles." M. HOLROYD SMITH. Dated August 11. 8d. Consists in details of construction and devices whereby the inventions for which Letters Patent Nos. 1,701, 1885, 5,664, 1886, 6,220, 1886, were granted to the inventor may be advantageously combined. The claims are 6 in number.

11285. "Improvements in the manufacture of rubber composition strips used in the manufacture of insulated wires and cables." R. HANNAN. (Communicated from abroad by J. J. C. Smith, of America.) Dated August 18. 6d. Claims:—1. Vu l

canising elastic rubber compound sheets, which are to be used for insulation of electric conductors between sheets of tinfoil, for the purpose and in the manner described. 2. The combination of tinfoil with rubber sheets during the process of manufacture, for the purposes and in the manner specified.

11390. "Improvements in the manufacture of elements or plates for secondary batteries or electrical accumulators." J. S. STEVENSON. Dated August 20. 8d. Claim:—In the manufacture of elements or plates for secondary batteries or electric accumulators casting the support or frame around the active material in moulds with the intervention of yielding material between the said active material and the faces of the mould, substantially as described.

11417. "Improvements in and connected with electrical connections with moving bodies." T. A. GARRETT. Dated August 22. 8d. Claims:—1. For effecting electrical connections with two or more armatures or bodies revolving in the same axis, the arrangement of two or more annular troughs insulated from one another and containing mercury in which separate conductors dip, substantially as described. 2. For making contact with a revolving body of mercury, the use of a disc free to revolve on a stationary conducting axis, with its boss immersed in mercury contained in a box attached to the axis, substantially as described. 3. For varying the immersion of the flange of a stationary conductor in a body of revolving mercury, arranging in the conductor a hole, putting the mercury in communication with a reservoir that can be raised or lowered, substantially as described.

11502. "Improvements in dynamo-electric and electro-dynamic machines." E. F. H. H. LAUCKERT. Dated August 23. 6d. Claims:—1. A bar conductor for the armatures of electric machines, consisting of a twisted strand of wire compressed to a rectangular section, substantially as described. 2. The described method of making bar conductors for the armatures of electric machines by first twisting wires together into a strand and then subjecting the strand to compression or hammering causing it to assume a rectangular transverse section.

11816. "Improvements in magnetic appliances for medical purposes." R. LONSDALE. Dated August 31. 8d. Claim:—In magnetic appliances for medical purposes the arrangement within covers or cases, as described, of strips of magnetised soft iron and of magnetised steel, either in the form of compound magnets or in alternate positions, substantially as described.

12645. "Improvements relating to means for carrying electrical batteries for driving tramway vehicles and for other purposes." W. D. SANDWELL. Dated September 17. 6d. Claims:—1. The combination with a tramcar or other vehicle or apparatus adapted to be driven by electricity of an electric motor mounted on the said car and a set of accumulators from which the electricity for operating the said motor is derived, the said accumulators being located in a truck or tender adapted to be connected with and disconnected from the tramcar, or the like, as set forth. 2. In combination with a tramcar adapted to be driven by electricity, a truck or tender adapted to run in conjunction with the said tramcar and to contain a set of accumulators from which electricity is derived for operating a motor on the car, substantially as described.

13758. "Improvements in electrical apparatus, especially applicable for use in dental operations." A. J. BOULT. (A communication from E. Smith and F. Kimble, both of America.) Dated October 11. 8d. Relates to an electrical apparatus and its application to dentistry, and has for its object to produce means whereby a current of electricity may be used with advantage to deaden the pain caused by dental operations. The invention further has for its object to produce means whereby the current may be regulated, and whereby also the current may be cut off instantly by the operators when desired. The claims are 6 in number.

13954. "Improvements in or appertaining to electrical railways." W. E. IRISH. Dated October 14. 11d. Relates to improvements in closed conduits which, through the agency of an elastic material, of which the conduit is partly or wholly composed, will admit of the opening or closing of an electric circuit on pressure, or release from pressure, at any point or points in the system, in combination with circuit closing rails for communicating electrically with moving objects, such as railway cars. The claims are 19 in number.

14062. "Improvements in automatic medical electrical apparatus." E. PULLAR. Dated October 17. 8d. Relates to the production of automatic apparatus for the application of electrical currents to one or more persons for the purpose of restoring diminished nerve power, and for the electrical treatment of disease generally, and has for its object the conservation of the energy of the battery when not in use. The claims are 3 in number.

14346. "An improved 'bell pull' electric light switch." A. P. LUNDBERG. Dated October 21. 8d. Claim:—The application of the recoil of a spring to work the switch mechanism, the spring to be either under compression or extension, the spring having been placed under compression or extension by the movement of a handle or cord through a fixed distance; the handle or cord fixed to the movable bar may move in any direction, *i.e.*, either vertically or horizontally or any given angle. This arrangement being used to secure a full and complete make or break in an electrical circuit.

14542. "Improvements relating to electric motors for driving tramway vehicles and for other purposes." W. D. SANDWELL. Dated October 25. 11d. Claims:—1. In an electric motor the employment of two armatures in connection with one set of field magnets, the said armatures and field magnets being arranged in such a manner that they can be moved relatively to each other for enabling either armature to work in the magnetic field, for the purposes specified. 2. In an electric motor the combination of two armatures with one set of field magnets, the said field magnets being adapted to move longitudinally with the armature shaft so that the said field magnets can be arranged to work in conjunction with either armature, substantially as described. 3. The modification of the invention wherein the armatures are adapted to be moved relatively to the field magnets, as set forth. 4. The application to a tramway or other vehicle of an electric motor such as described, substantially as set forth. 5. The manufacture and use of the improved electric motor, constructed and arranged substantially as described with reference to the drawings.

15703. "A galvanic battery for medical purposes." J. COURT. Dated November 16. 8d. The inventor forms a miniature battery by the combination of metal plates and spirals. The spirals form springs which he places between the metal plates, these being pressed together by the heel in walking, cause a friction of the metals, and a galvanic action is set up; he also places cotton shreds connecting the metals with the heel of the foot, conveying the moisture of the foot to the metals, and thus further exciting to galvanic action. He also brings the terminals of the spirals through the top of the battery to conduct the current to the heel. The claims are 3 in number.

16473. "An electrical signalling device for railway purposes." S. S. BROMHEAD. (Communicated from abroad by S. T. Street, of America.) Dated November 30. 8d. Consists of an electrical signalling device for indicating the approach of railway trains at highway crossings or other places remote from the operating mechanism of the signal circuit, which is put into action by an approaching and passing train. The claims are 6 in number

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## 1888.

2515. "Improvements relating to dynamo-electric generators and motors." J. FEAVERYEAR. Dated February 20. 8d. The object of the invention is to arrange the magnetic field of what is generally known as a continuous current dynamo-electric generator in such a manner as to allow of a constant electromotive force being maintained at the terminals, irrespective of any variation of the resistance of the external circuit; or, if required, the same generator or electric motor may have its field magnets placed in series with the external circuit, in which case any variation of the external resistance would cause a corresponding variation of the electromotive force at the terminals when the apparatus is used as a generator. The claims are 6 in number.

3685. "Improvements in electrical switches." S. SHARP, J. M. V. MONEY-KENT and H. J. PAYNE. Dated March 9. 8d. Claims:—1. In an electrical switch the hereinbefore described means of both making and breaking electric contacts instantaneously and positively, consisting in the use of a rotary block adapted to be turned through a given distance in either direction by the operating handle, and then to be instantaneously sprung over by a special arrangement of springs to a position the reverse of its first position carrying with it a contact bar independently of furthur action of the handle and the control of the operator, for the purposes set forth. 2. In an electrical switch the use in combination of a rotary block carrying a pin or pins, fixed independent springs, a free contact bar and a starting handle, all constructed, arranged and operating substantially as and for the purposes set forth. 3. The specific arrangements of working parts constituting the hereinbefore described improvements in electrical switches, for the purposes set forth.

3740. "An improved combined cut-out and switch." A. BERNSTEIN. Dated March 10. 6d. Claims:—1. In a combined switch and cut-out, the combination of two insulated standards, one of which is provided with a screw thread for the reception of the cut-out plug, and a metallic spring which is firmly attached to one of the said standards and adapted to make contact with the other, this contact being regulated by the position of the plug, substantially as described. 2. The manufacture and use of the above described combined switch and cut-out.

3835. "Improvements in telegraphic apparatus." H. P. COPELAND. Dated March 13. 8d. In this invention the operator writes in the Morse or other characters whatever message he desires to send, and, in doing so every time the pen makes a mark upon the paper or other receiving surface, he presses a button against a contact. This causes a closure of the electric circuit and a corresponding action upon the sounder or other receiving apparatus at the distant station. The claims are 7 in number.

3995. "Improvements in and relating to galvanic batteries." H. H. LAKE. (Communicated from abroad by H. Walter, of America.) Dated March 15. 8d. The object of the invention is to construct a battery for open circuit work which shall be compact in form, permanently and hermetically closed or sealed, and perfectly portable, and which by the enormous surface of depolarising material will be capable of doing more work than batteries of the kind heretofore used. The claims are 6 in number.

## CORRESPONDENCE.

### Electrical Workman's Club.

My letter, printed in the issue of the 3rd, appears to have missed its mark upon the mind of Mr. M. Howard. I am thankful to all that will add anything that will enlighten the darkened vision of *men of my class*. But it is light! light! more light that we want. But let us not have a club only, but a thorough amalgamation with other great Trades Unions, with the Board of Trade certificates of competency to all workers, or of some other responsible body, with the recognition and support of the public generally. What I pointed out was that a few members of a club only, without some such security, will not be able to hold the field against the large number of trades and professions of all sorts that enter it as electrical workers, without having giving it, perhaps, even 5 minutes' study, and who can, and do, undersell them in the labour market, as occasion offers, and who in slack times can fall back again upon their own trades, leaving the electrical workman, who depends solely upon it, and having no other trade—where? Mr. M. Howard's experience must be limited if he has not observed that. Of course, I refer principally to those engaged in installation work, which is, I believe, the special object of the club. The question asked is quite uncalled for, as my former letter shows that it is often unnecessary to be possessed with electrical knowledge to be able to earn the munificent sum of 20s. per week to do electrical work, and to get it; because, right or wrong, he can do just as he's told as well as the electrical workman proper, who is outside, because he must not work for less than two pounds. I believe, then, only in a widespread understanding, combination, and a certain security for a special class. I would that my supposed delusion were dispelled, but facts are stubborn things, and will outlive me yet, I hope, to see some changes in the way of installation work where greater security, economy, and simplicity are practised, yet requiring more ability on the part of those employed, with only greater common sense rules, if any are necessary, and void of contention; and now we come to the point raised of giving certificates, as is sometimes done, on completion of an installation. It would occupy too much space to give any sort of complete answer here; but, as *a sensible* man, and with all due respect to gentlemen whom I have met in that capacity, I must add, any inspection required should be done by thorough practical men only, and the work properly in the hands of those that are masters of their profession, and know well what they are about; it is open to all, and all are welcome to achieve it. Then, as workmen or masters, let us do so, and see that the institutions of which we would be members are not fallacious, but founded upon as sound a basis as we can make them, such as is afforded by free discussion, and nothing that shall simply nurse the existing state of things, or we may be better without them. Have we not enough rich institutions at the expense of the poor already, that do too little for them when the grey future dawns and finds them in the lunatic asylum or workhouse, without even the chance or satisfaction of having accumulated a fortune and lost it. I certainly was not sensible of putting a certain "gentleman's" reputation at stake, or any other *electrician*, nor did I single out any particular calling to be held up for opprobrium, but simply as an example of $q + x = y$. I fail to see where I, and those that share my views, can be rightly accredited with a desire to crush the British workman, for such is very far removed from my wishes and intention. I believe we could, and should, move faster in this mundane sphere, but for the want of unity in the various ranks and societies which already exist. I hope this will be a sufficient expiation, as I cannot well enlarge upon my *views* in a letter which is already long, but hope what I have written will be calculated to be of benefit rather than the reverse, and I shall here tender my thanks to our able Editors of this Journal, who have before championed the cause of the British workman in a Press notice of a case that happened not long since, when all others made much of one side of a question but were quite silent of the other and real facts. Question, Why should not working men co-operate to carry on a great industry, say a central lighting station, as well as a school? They could do it.

**H. Raison.**

### Galvanic Belt Quackery.

I am pleased to see Dr. Andrew Wilson's letter which appeared in your issue of August 10th. The learned doctor, let it be understood, confesses that the electropathic belt is a bogus one. This statement should help our cause materially, coming as it does from the pen of a scientific gentleman. Now let us for a moment revert to this so-called medical battery belt to which the doctor refers. This belt was contrived by a workman for Harness to satisfy Mr. Lant Carpenter, who was at the time writing articles on "Bogus Electrical Appliances." It was constructed as follows: Two cells Zn and Cu with moistened blotting paper between; E.M.F. of two cells 1·8, internal resistance enormous. If Mr. Lant Carpenter's test coincides with mine, we certainly must agree that even the medical battery belt is a worthless article as an electrical curative agent.

This belt there is no doubt was got up as a blind. I do not believe it was ever sold to the public. The *disc* belt was always offered. Only one or two of the belts mentioned by Dr. Wilson, I have heard, were kept in stock, and they were only brought out when demanded.

I have no desire whatever to clash with the worthy doctor; on the contrary, I and my friends wish to work in conjunction with the medical profession with the object of ridding the country of those who are a curse to science and humanity, but I cannot refrain from asking him the following questions:—

Did he know that Harness sold exactly the same appliance as Mr. Carpenter condemned at the time that his eulogistic notice appeared?

Was Dr. Wilson a director of the Ammoniaphone Company, which company was floated by C. B. Harness, at the time he wrote that testimonial?

It is of course well known that the said company has been wound up, the poor victims who invested their money in shares having lost every penny.

Was it after Mr. Carpenter had shown up the bogus belt swindle in *Health* that Dr. Wilson became a director of Harness's Ammoniaphone Company? If so, I'll say no more.

**J. Jerritt,** *A.S.T.E. & E.*

*August 13th*, 1888.

ERRATUM.—In my last please read "Mrs." after the words "I see a."

### Telegraph Survey and Construction.

Mr. Gilbert has got out of a hole again, but by the usual undignified wrong-end foremost process. His courage is that of the man "who fights and runs away, and lives to fight another day." From behind a hedge of rotten reservation, he flings mud at the heads, not only of responsible engineers, but of telegraph foremen and inspectors, and shirks legitimate criticism when it is offered. Does he forget that every article which appears in the REVIEW is subject to the criticism of any of your readers, or is he presumptuous enough to believe that you will close your columns in this particular case to all but responsible railway engineers. If such is his opinion of public journalism, it is, I would say, as grotesque as his views on "telegraph survey and construction" are trifling. My letter of 30th July sufficiently proves that "they don't know everything down in Judee," and I would remind Mr. Gilbert that although the castigation of weak points, hurts; it is better not to make the suffering worse, by any backward movement.

It is only a matter of months yet, since Mr. Gilbert

was himself an inspecting subordinate, and as he is not even now a fully fledged engineer, but only an official responsible to the line engineer, there is little modesty in the statement that his "time is too valuable to be wasted in answering communications on this important subject from parties holding subordinate positions, and who are minus a reasonable knowledge on the subject on which they venture to write."

Some folk believe he has got too hard a nut to crack, and that his teeth will require to grow a bit before he undertakes it.

**Jno. McDonald.**

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### Electric Lighting of Railway Trains.

Illness prevented my at once accepting the invitation thrown out in one of your leading paragraphs of the ELECTRICAL REVIEW of the 27th July last, to disclaim having been concerned in the train lighting on the Great Northern Railway, which I now do; I believe the work has been carried out with great skill and in a very successful manner by Mr. Radcliffe, telegraph engineer of that Company.

I think, however, that I ought at the same time to state that I believe the system of lighting railway trains by a dynamo driven from an axle, in combination with accumulators and controlling devices, was first brought forward by me.

This system and appliances are described and illustrated in my patent No. 2,538 of 1881; the patent is in a peculiar position, and may be made (should it appear likely to aid electric interests by giving special inducements to materially increase the capital employed in the work) the subject of a special Act of Parliament.

This method of lighting railway trains was also first put into practice under my supervision, acting for electric interests and with the help of Mr. Stroudley, locomotive superintendent of the Brighton Railway Company, whose prompt and energetic use of his resources at the Brighton Railway works enabled us to quickly fit up the Kemp Town and Brighton shuttle train. This (I forget without referring to dates whether it was at the end of 1881 or beginning of 1882) was the first train lighted by accumulators kept charged by a dynamo worked off the axle.

As a matter of accurate justice I suppose the system ought to be spoken of as my system, but for some years circumstances have prevented my giving much attention to train lighting, so I have not been driven to pay much heed to the point.

No doubt auxiliary and useful details have been devised both by Messrs. Stroudley and Houghton, and Mr. Radcliffe on the Great Northern; there was also something done in this way before either of these gentlemen, by some French gentleman whose name I forget without reference.

**Radcliffe Ward.**

London, *August* 14*th*, 1888.

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### Electrical Locomotion.

As Mr. Elieson's note in your issue of the 10th inst. does not immediately follow my letter in the ELECTRICAL REVIEW of the 27th July, perhaps you will allow me to observe that whether Mr. Elieson is right in saying that my corrections do not materially alter facts, can best be seen by the real facts I give in my letter in your number of July 27th.

I do not understand what he means by saying he thinks I have lost a good opportunity of leaving in ignorance those who were not already aware that I ran the Leytonstone car. It seems as if he wished to convey the impression that I had something to be ashamed of. My connection with the matter is clearly stated in my letter on July 27th, and I am proud to have taken the part I did in the inauguration of electric tramway work here.

I regret the ungenerous tone of Mr. Elieson's note. I do not think my letter contained anything of this character, which is neither profitable reading nor technical criticism. Opinions on construction and carrying out of details may have tempted me to criticise his methods, but I have hitherto looked at his work in its broad aspects, and written of it accordingly.

**Radcliffe Ward.**

London, *August* 14*th*.

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### A Correction.

In your Journal of the 6th July, page 15, you say that my engines drive the dynamos of the Anglo-American Brush Company. This is incorrect. I have no engine at all at the Brussels Exhibition.

I rely, Sir, upon your fairness to rectify the article in question in the earliest number of your valuable Journal.

Please send me the number containing this correction; you will easily understand the considerable injury which you have done me.

I hope that the present letter will be sufficient for you; it would be disagreeable to me if you compel me to use other means. In the meantime I remain,

**L. Van Acker.**

Brussels, *August* 11*th*, 1888.

[Our correspondent must surely have seen, if he read the note at all carefully, that the mention of Brussels Exhibition was on the authority of our contemporary, *Industries*. We fail to see how any injury can possibly have happened to M. Van Acker, considering that he did not exhibit. The last paragraph of his letter is highly amusing, and shows that M. Van Acker is endowed with a fine touch of humour.—EDS. ELEC. REV.]

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### The Institute of Medical Electricity.

As you and many of your readers have expressed considerable interest in this Institute, the directors would feel obliged if you will allow me an opportunity of making known in your columns the reason why the opening of our London establishment has been so long delayed.

In the end of March last the directors proceeded to the appointment of medical officers, and after consultation with the medical visitors, selected two distinguished London physicians well known in scientific circles for the great attention they have long given to the medical applications of electricity.

These gentlemen, however, happen to be, one a Fellow and the other a Member of the Royal College of Physicians, and, though they were personally willing, unexpected difficulties of a purely professional character have been encountered in connection with their acceptance of the posts offered to them. The directors hoped at one time that a memorandum on the subject, which was signed by ten of the leading men in the electrical profession, all being members of the Council of the Society of Telegraph Engineers and Electricians, and six of them being also Fellows of the Royal Society, would have aided in removing these difficulties, but I regret to say that they are still unsurmounted.

I need hardly assure your readers that this unfortunate *contretemps* will in no way alter the character and tone of the Institute, but that being more than ever convinced of the need for such an undertaking, and of the good that may come from it, the directors will proceed with a medical officer who is not a member of the Royal College of Physicians.

These premises are now being fitted up rapidly with all the necessary apparatus, and the directors hope that they will be ready to receive patients early in September. They think it expedient, however, to defer the formal opening until October, when they hope to gather their friends around them.

**H. Newman Laurence**, *Managing Director.*

The Institute of Medical Electricity, Limited,
24A, Regent Street, London, S.W.,
*August* 11*th*, 1888.